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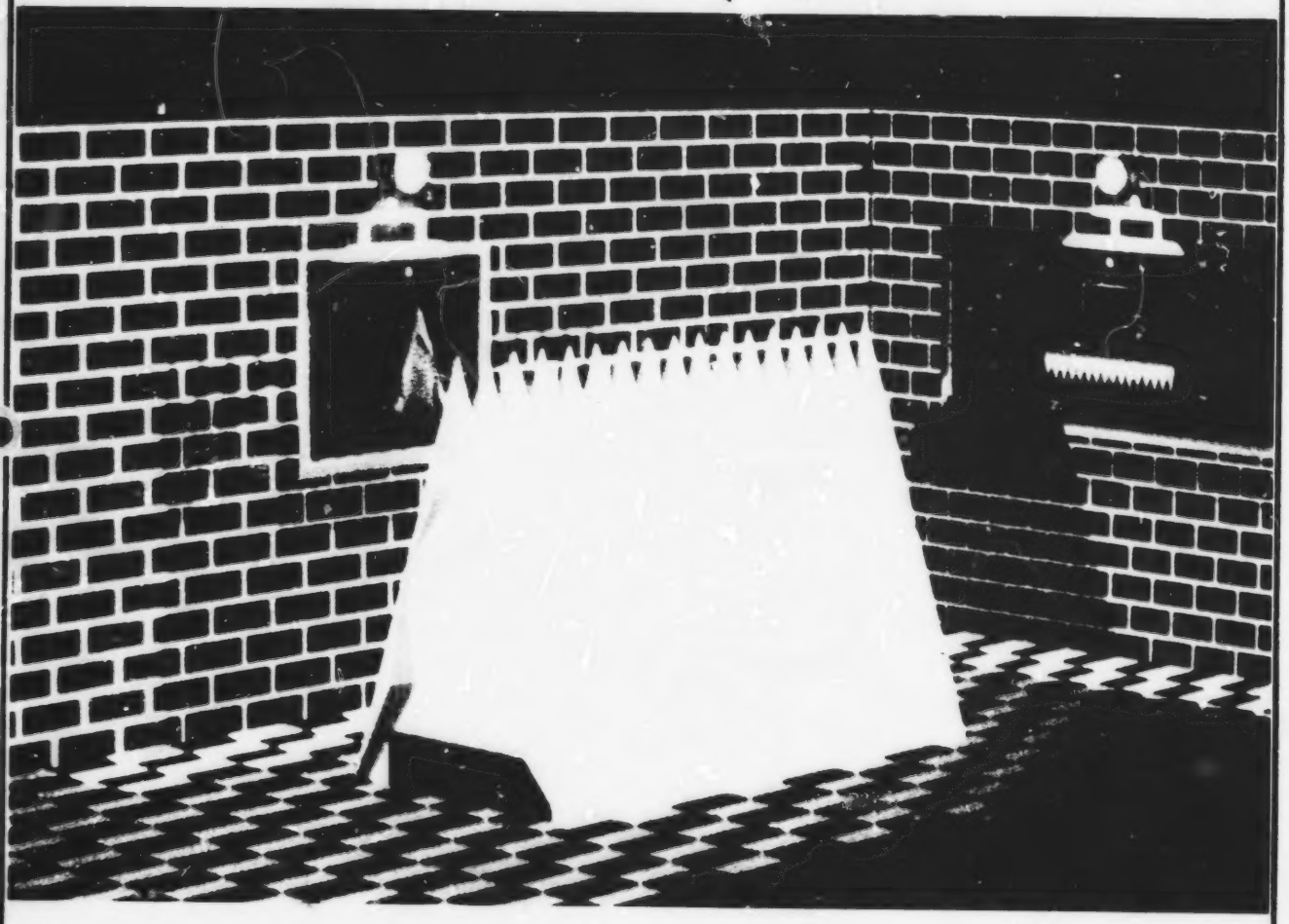

1987 RESEARCH PUBLICATION

Dean of Faculty United States Air Force Academy

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DISCOVERY

FACULTY PUBLICATIONS and PRESENTATIONS

FISCAL YEAR 1986

Books, Texts, Manuals, Chapters
Papers, Reports, and Presentations

by

Members of the Faculty
United States Air Force Academy

The Office of the Director of Research and Computer Based Education
Robert L. James, Lieutenant Colonel, USAF
October 1986

Compiled and Edited by
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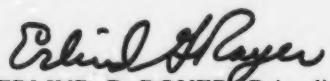
Colorado Springs, Colorado 80840

I

This edition of *Discovery* documents our efforts in research over the last year. From the most basic research which extends the knowledge of the world, to specific applications of that research to solve today's problems, the members of the Academy faculty and the Frank J. Seiler Research Laboratory offer this as a record of our accomplishments. A fundamental purpose of the Academy is to pass on the knowledge of today to the leaders of tomorrow--and our research strengthens and expands that base of knowledge.



ERLIND G. ROYER, Brigadier General, USAF
Dean of the Faculty

TABLE OF CONTENTS

A—Aeronautics 1

B—Astronautics 7

C—Behavioral Sciences and Leadership 15

D—Biology 23

E—Chemistry 27

F—Civil Engineering 35

G—Computer Science 37

H—Economics and Geography 41

I—Electrical Engineering 45

J—Engineering Mechanics 49

K—English 57

L—Foreign Languages 63

M—History 67

N—Law 71

O—Management 75

P—Mathematical Sciences 77

Q—Philosophy and Fine Arts 85

R—Physics 91

S—Political Science 101

T—Military Instruction 105

U—Frank J. Seiler Research Laboratory 107

Author Index 123

Subject Index 131

"For More Information . . ." 141

RESEARCH AT THE UNITED STATES AIR FORCE ACADEMY

Once again, research at the United States Air Force Academy has touched the arts and sciences across the spectrum. Well over one hundred new faculty members arrive each year, each with a unique insight into the world around us. This dynamic change of the composition of the faculty gives us our strength in two ways. In our teaching, we provide role models for the cadets who bring fresh field experience to the classroom. And in our research the new faculty bring their fresh ideas for projects in their individual specialities. That's what makes research at the Academy so different from that of our comrades in higher education.

We have had particular success this year with several interdisciplinary projects, which benefited from the right combination of people, interests, and time. Also, a growing number of projects involve cadets through their senior research course. You'll see several examples of both of these as you browse through *Discovery*.

Please don't hesitate to call us if you want more information, or wish to propose a topic which may find a home in the research time of some member of our faculty.

Robert L. James

ROBERT L. JAMES, Lt Colonel, USAF
Director of Research

CHAPTER A

DEPARTMENT OF AERONAUTICS

Our mission is to develop in each cadet the ability to apply the correct fundamentals of aeronautical engineering in order to identify and solve new problems, and to help the cadet develop the knowledge, character, leadership, and motivation essential to be a career officer in the United States Air Force. We help each cadet develop an understanding of aeronautical research methods by conducting wind tunnel, propulsion and flight test experiments. In addition, our continuing experimental research provides a new and challenging environment for both instructors and students to apply fundamentals and develop an understanding of research methods.

1. BYERLEY, Aaron R., Captain and Assistant Processor

a. With Lt Colonel Robert C. Winn. "CAI in Thermodynamics at the USAF Academy." *Engineering Education*, American Society of Engineering Education, February 1986. (Article)

We report on the use of Computer Aided Instruction in Aero 312, Engineering Thermodynamics, and describe two interactive programs that tutor cadets in refrigeration and perfect gas equations.

2. DUPREY, Richard J., Captain and Instructor

a. Work in Progress

With Dr. David Quam (Independent Consultant). *Augmented Flight Vehicle Dynamics*. (Textbook)

3. GILLIAM, Fred T., Lt Colonel and Associate Professor

a. With Major John Russell, Dr., Mike Robinson (University of Colorado), First Lieutenant Henry Helin (University of Colorado) and Major John Walker (Frank J. Seiler Research Laboratory). "Visualization of Three-Dimensional Forced Unsteady Separated Flow." American Institute of Aeronautics and Astronautics (AIAA) Fourth Fluid Mechanics, Plasma Dynamics and Laser Conference, AIAA Paper 86-1066, Atlanta, GA, May 1986. (Paper)

We present the findings from a series of wind tunnel experiments on pitching three-dimensional wings. Flow visualization showed the existence of strong dynamic stall vortices above the wing surface.

b. "Aerodynamic Performance of the Subsonic Wind Tunnel at the U.S. Air Force Academy." Twenty-second Annual Conference of the Subsonic Aerodynamic Testing Association, Goteborg, Sweden, Septenber 1986. (Presentation)

I presented the results of the aerodynamic flow quality tests that were conducted on our new wind tunnel facility.

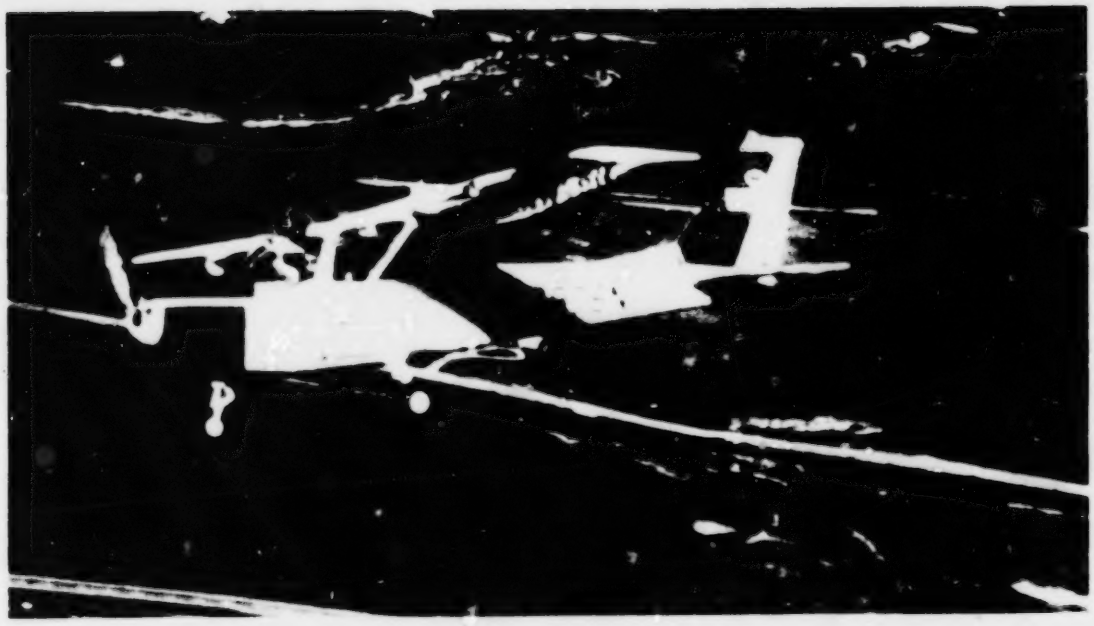
c. Work in Progress

With Captain John Wissler, Major John Walker (Frank J. Seiler Research Labratory) and Dr. Mike Robinson (University of Colorado). "Visualization of Unsteady Separated Flow About a Pitching Delta Wing." (Paper and Presentation)

4. HALLGREN, Wayne F., Captain and Associate Professor

a. Work in Progress

"Aerodynamics of Wings" Chapter of the "Handbook of Engineering Fundamentals" by Ovid W. Eshbach (Late Dean, Northwestern Technical Institute). (Edited Work)



The Department of Aeronautics is using a specially instrumented T-41 to conduct flight tests on a new type of experimental instrumentation for use on the X-29.

5. HARVELL, John K., Captain and Instructor

a. "Multiple Jet Blowing Around the Blunt Trailing Edge of a Circulation Controlled Airfoil." United States Patent awarded (Patent Number 4,555,079), November 1985. (Patent)

This patent describes a method of providing maximum lift augmentation for the least power usage.

b. With Dr. Milton E. Franke (Air Force Institute of Technology). "Wind Tunnel Studies of Circulation Controlled Elliptical Airfoils." Circulation and Control Workshop, NASA-Ames Research Center, 19 February 1986. (Paper and Presentation)

We gave an overview of experimental research in circulation control airfoils conducted at the Air Force Institute of Technology.

6. KING, Paul I., Major and Associate Professor

a. "Aerodynamics of High Performance Turbine Blading." Oxford University, England, March 1986. (Dissertation)

I analyze transonic turbine blade flow phenomena using transient measurement techniques in a blowdown wind tunnel.

7. KLINE, Larry R., Captain and Instructor

a. Work in Progress

"Transonic Flutter Analysis of Some Rectangular and Swept Wings." (Dissertation)

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Captain Efren Strain and C1C Chris Williams examine the flow visualization tufting on a subsonic airfoil before beginning a series of experiments.

8. MARTIN, Harold L., Captain and Instructor

a. With Dr. Michael G. Dunn (Calspan Advanced Technology Center). "Heat Flux and Pressure Measurements and Comparison with Prediction for a Low Aspect Ratio Turbine Stage." American Society of Mechanical Engineers International Gas Turbine Conference, Paper 86-GT-79, Dusseldorf, Germany, 12-15 May 1986. (Paper and Presentation)

I presented the analysis of heat flux and pressure measurements I gathered on a full-stage, full-scale rotating turbine stage. I also compared analytical predictions and measured data.

9. MATTINGLY, Jack D., Lt Colonel and Associate Professor

a. With Dr. William H. Heiser (Vice President, Propulsion Research Institute, Aerojet General) and Brigadier General Dan Daley (USAF, Retired). "Performance Estimation of the Mixed Flow, Afterburner, Cooled, Two Spool Turbofan Engine with Bleed and Power Extraction." American Institute of Aeronautics and Astronautics, American Society of Mechanical Engineering, Twenty-Second Joint Propulsion Conference, Huntsville, Al, 16 June 1986. (Paper and Presentation)

We developed a simplified model of the mixed flow, afterburning turbofan engine which retains the major engine design variables and predicts engine off-design performance, yet is understandable by senior engineering design students.

10. RUSSELL, John H., Major and Assistant Professor

a. With Chuen-Yen Chow (University of Colorado). "Unsteady Forces Acting on a Flat Plate Airfoil Undergoing Chord Deformations." American Institue of Aeronautics and Astronautics (AIAA) Twenty-Fourth Aerospace Sciences Conference, AIAA Paper 86-0121, Reno, NV, January 1986. (Paper and Presentation)

We analyzed and reported on the unsteady lift generated by a flat plate airfoil undergoing time-dependent chord formations.

b. With Dr. Mike Robinson (University of Colorado), Lt Colonel Fred Gilliam, Major John Walker (Frank J. Seiler Research Laboratory) and First Lieutenant Henry Helin (University of Colorado). "Visualization of Three-Dimensional Forced Unsteady Separated Flow."

See A3a

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11. STRAIN, Efren C., Captain and Assistant Professor

a. Work in Progress

"Dynamic Pressure Measurement Using 0.022 Inch Plastic Tubing and a Zero Order Calibration Valve." (Paper)

12. WINN, Robert C., Lt Colonel and Associate Professor

a. With Captain Aaron R. Byerley. "CAI in Thermodynamics at the USAF Academy." *Engineering Education*, American Society of Engineering Education, February 1986. (Article)

See A1a

b. "How to Fairly Account for an Excused Exam." Air Force Academy Aeronautical Digest, USAFA, October 1985. (Article)

I presented a procedure and computer program for assigning a fair grade to a student who misses an exam, regardless of ease or difficulty of the missed exam.

13. WISSLER, John B., Captain and Instructor

a. "A Hot Wire and Schlieren Investigation of Karman Vortex Sheets." Air Force Institute of Technology, Wright-Patterson AFB, OH, December 1985. (Thesis)

I describe how to use a Schlieren optical system and a Hot Wire Anemometer to obtain individual vortex velocity profiles in a Karman Vortex Sheet in support of research into shock waves and their effect on turbulence.

b. Work in Progress

With Lt Colonel Fred Gilliam, Major John Walker (Frank J. Seiler Research Laboratory) and Dr. Mike Robinson (University of Colorado). "Visualization of Unsteady Separated Flow About a Pitching Delta Wing." (Paper and Presentation)

Captain John Wissler and Mr. Butch Dawson run a pre-test instrumentation checkout on a J-85 Turbojet engine prior to conducting a series of test runs.

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14. YECHOUT, Thomas R., Lt Colonel and Associate Professor

a. "Modeling of Aircraft Cruise Performance Using Acceleration and Deceleration Maneuvers--Results and Applications." American Institute of Aeronautics and Astronautics (AIAA) Third Flight Testing Conference, Las Vegas, NV, AIAA Paper 86-0735, April 1986. (Paper)

I presented a method for defining aircraft cruise performance using accelertion and deceleration maneuvers. I projected significant savings in flight test time and presented actual flight test results.

b. Work in Progress

X-29 Flight Test Program, Defense Advanced Research Projects Agency (DARPA), Arlington, VA, August 1984 to present. (Consultation and Research)

"A Flight Test Structural Flexibility Correction for Performance Parameters." (Article)

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CHAPTER B

DEPARTMENT OF ASTRONAUTICS

The mission of the Department of Astronautics is to develop graduates who are motivated and prepared for careers as competent professional officers with educational specialities in astronautics and space science. Course offerings and faculty research emphasize astrodynamics, space system design, and control systems with applications to the Space Shuttle, satellites, and launch vehicles.

1. ACKER, Bruce H., Captain and Instructor

a. "Multivariable Output Control Law Design for the STOL F-15 in Landing Configuration." National Aerospace and Electronics Conference, Dayton, OH, 19-23 May 1986. (Thesis and Presentation)

I designed multivariable, output feedback control laws for the short take-off and landing F-15 aircraft in the landing configuration. My results showed that multivariable control, limited to output feedback, was a viable option for designing control laws for fighter aircraft.

b. Work in Progress

"SDI Large Space Structures." (Research)

2. ANTHONY, John F., Major and Assistant Professor

a. With Majors Michael L. DeLorenzo, Robert S. Fraser (Secretary of the Air Force, SP-6), Daniel E. Mercier and Ralph H. Tate, III. *Handbook of Engineering Fundamentals*. ed. Eshbach. "Astronautics." (Forthcoming Chapter)

See B20a

Major Boden checks an orbit determination algorithm.

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3. BODEN, Daryl G., Major and Assistant Professor

a. With Dr. Bruce A. Conway (University of Illinois). "A Comparison of Nonlinear Filters for Orbit Determination." American Institute of Aeronautics and Astronautics/American Astronautical Society Astrodynamics Conference, Williamsburg, VA, 19 August 1986. (Presentation and Paper)

We compared the performances of a nonlinear least squares filter, an extended Kalman filter, and a second order Gauss filter when applied to the problem of orbit determination.

b. Work in Progress

"Orbit Determination." (Research)

4. BUBB, Keith W., Captain and Instructor

a. Work in Progress

"Space Shuttle Flexible Beam Experiment." (Research)

5. DAVIS, James A., Major and Assistant Professor

a. Work in Progress

"Model and Controller Reduction for Large Space Structure Control." (Research)

6. DeLORENZO, Michael L., Major and Associate Professor

a. With Major Marv Becker (DFEM), Captain Robert J. Ciaffa (DFENG), Captain Janice B. Cope (DFENG), Captain Ron Fursteneau (DFC), Major Roger Healy (DFEE), and Major Jerome Pradier (DFBL). *Discovery: 1986 Dean of Faculty United States Air Force Academy Research Publication.* (Edited Work)

b. With Captain John F. Anthony, Major Robert S. Fraser (Secretary of the Air Force, SP-6), Major Daniel E. Mercier, and Major Ralph H. Tate, III. *Handbook of Engineering Fundamentals.* ed. Eshbach. "Astronautics." (Forthcoming Chapter)

See B20a

c. With Lt Colonel Jim Durham (DFP), Lt Colonel Douglas H. Kirkpatrick, Captain Dave Lewis (DFP), Major Kent Magnusson (DFBL), Captain Jim McBride (50th ATS), Lt Colonel Tom McCloy (DFBL), Captain Nancy Rhoades, Captain Mitchell P. Slate, Captain Silvi Steigerwald (DFEE), Major Ralph H. Tate, III., and Lt Colonel John Wood (DFBL). "Space Academics Short Course." July 1986. (Presentation)

SeeB25a

d. Work in Progress

"Sensor and Actuator Selection for Large Space Structure Control." (Researach)

7. DRAKE, Marc C., Captain and Instructor

a. Work in Progress

"Control of Large Space Structures." (Researach)

8. FAZIO, Salvatore, Jr., Major and Assistant Professor

a. With Lt Colonel Douglas H. Kirkpatrick. "Decision Evaluation Papers on Strategic Defense Initiative Gaming." Sponsored by Strategic Defense Initiative Organization, Office of the Secretary of Defense, The Pentagon, Washington D.C., May 1986. (Edited Work)

See B14a

9. FRANCE, Martin B., Captan and Instructor

a. With Captain M. Scott Trimboli. "Navigation Guidance and Control Curriculum at the Air Force Academy." Annual American Astronautical Society Guidance and Control Conference, Keystone, CO, 1-5 February 1986. (Paper and Presentation)

We presented a history of the navigation guidance and control curriculum at the Academy since 1965. We also highlighted current research interest and teaching innovations in this area.

b. With Major Ralph H. Tate, III., and Captain M. Scott Trimboli. "Undergraduate Space Training (UST) Program." Sponsored by Space Command, Colorado Springs, CO, July 1986. (Consultation)

We developed lesson objectives and lesson plans for the Astrodynamics and rocket propulsion sections of Space Command's UST Program.

10. GIFFEN, Robert B., Colonel, Permanent Professor and Department Head

a. "Space System Survivability." United States Air Force Air Command and Staff College, Maxwell AFB, Montgomery, AL, May 1986, and U.S. Naval Postgraduate School, Monterey, CA, June 1986. (Presentations)

In these presentations I proposed a systematic way to reduce the vulnerability of our critical space assets. The focus was on the survivability across the spectrum of conflict of space systems vital to the national defense.

Captain Hall investigates a digital simulation technique.

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11. HALL, Roger L., Captain and Instructor

a. Work in Progress

"Micro Computers in Digital Control Labs." (Research)

12. HESS, Jeffrey W., Captain and Assistant Professor

a. With Captain Rosario Nici. "Guessing: Blow it Away with Mega Choice." American Society of Engineering Educators Rocky Mountain Section Meeting, Laramie, WY, 17 April 1986. (Presentation)

We developed a new form of multiple-choice test originally used by Illinois State Geography professor Paul Anderson. This test allowed up to a hundred choices for each question, while at the same time retaining the characteristic ease of grading of the standard multiple choice test.

b. With Captain Rosario Nici. "Mega Choice Blows Guessing Away." *ACQ*, Vol. VIII, Number 1, 1986. (Article)

We developed a test to replace the standard Astro 332 multiple-choice test with one requiring a better comprehension of the course material. We presented guidance on how to write a Mega Choice test as well as the results of a survey showing an improved comprehension level.

c. "A Parametric Examination of the Stability Robustness Characteristics of Two Decoupled Controllers for Large Space Structure Control." American Institute of Aeronautics and Astronautics Guidance Navigation and Control Conference, Williamsburg, VA, 18-20 August 1986. (Presentation and Paper)

I compared the stability robustness characteristics of two decoupled controllers previously designed at the Air Force Institute of Technology for use in controlling the vibrational modes of flexible space structures.

b. Work in Progress

"SDI Issues." (Research)

13. HUMBLE, Robert M., Staff Sergeant

a. With Captain Christopher J. Worsowicz. "Space Shuttle Flexible Beam Experiment." Sponsored by Space Division and the Air Force Weapons Laboratory. (Paper)

See B31a

14. KIRKPATRICK, Douglas H., Lt Colonel, Associate Professor and Acting Head

a. With Major Salvatore Fazio, Jr. "Decision Evaluation Papers on Strategic Defense Initiative Gaming." Sponsored by Strategic Defense Initiative Organization (SDIO), Office of the Secretary of Defense, The Pentagon, Washington D.C., May 1986. (Edited Work)

We edited student papers prepared during our Department's Engineering 495 course, which is an interdisciplinary course designed to study the political and technical issues of the Strategic Defense Initiative. The papers were briefed to the Chief of Staff and the Chief of SDIO in May 1986.

b. With Major Michael L. DeLorenzo, Lt Colonel Jim Durham (DFP), Captain Dave Lewis (DFP), Major Kent Magnusson (DFB), Captain Nancy Rhoades, Captain Mitchell P. Slate, Lt Colonel Tom McCloy (DFBL), Captain Jim McBride (50th ATS), and Lt Colonel John Wood (DFBL). "Space Academics Short Course." July 1986. (Presentation)

See B25a

c. Work in Progress

"GPS Navigation Accuracy in a Degraded Mode." (Dissertation)

15. LEUTHAUSER, Paul R., Captain and Assistant Professor

a. Work in Progress

"Computer Aided Instruction for Astrodynamics." (Research)

16. LIEFER, Randall K., Captain and Instructor

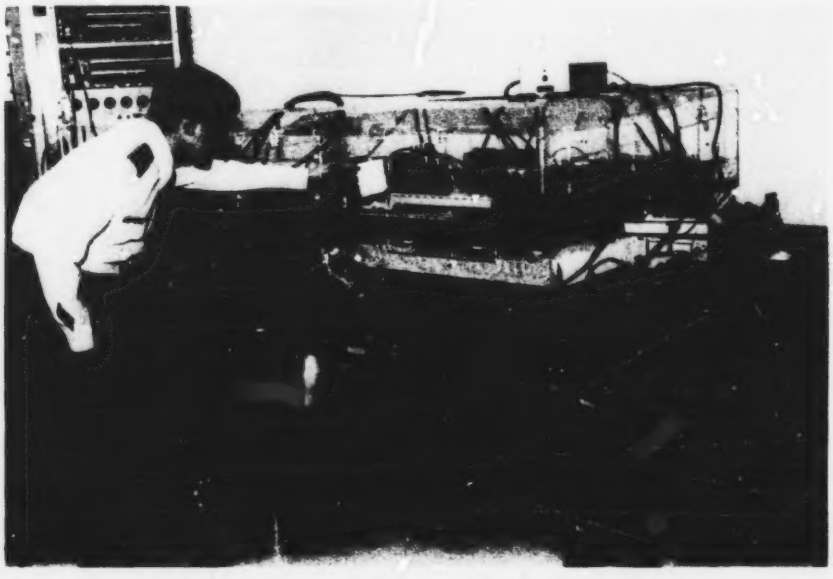
a. Work in Progress

"Strategic Defense Initiative Fire Control." (Research)

17. LISOWSKI, Ronald J., Major, Tenure Professor and Deputy Head

a. Work in Progress

"Joint Optics Structure Experiment." (Research)



Captain Lorenz adjusts a passive ring laser gyro.

18. LORENZ, Mark A., Captain and Instructor

a. With Lt Colonel Daniel J. Biezad (Air Force Institute of Technology) and Major James R. Rotge (Frank J. Seiler Reserach Laboratory). "A Laser Feedback Control Design for Passive Ring Laser Gyros for Use in High Sensitivity Applications." American Institute of Aeronautics and Astronautics Guidance and Control Conference, Williamsburg, VA, 18-20 August 1986. (Presentation and Paper)

We describe the control aspects of locking a HeNe laser to a high finesse cavity by which we obtanied an ultra sensitive ring laser gyro.

b. With Lt Colonel Daniel J. Biezad (Air Force Institute of Technology) and Major Gerald L. Shaw (Frank J. Seiler Research Laboratory). "A Laser Feedback Control Design for Passive Ring Laser Gyros in a Very High Finesse Cavity." SPIE Optical Testing and Metrology Conference, Quebec City, Canada, 3-6 June 1986. (Presentation and Paper)

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We present a unique design for a passive ring laser gyro whereby the linewidth of a HeNe laser is narrowed by frequency, locking the laser to a high finesse resonant optical cavity.

c. "Geokinetics and Inertial Sensors." American Institute of Aeronautics and Astronautics Guidance and Control Conference, Williamsburg, VA, 18-20 August 1986. (Consultation)

I served as chairman for this session of the conference.

d. Work in Progress

"Ring Laser Gyros and Graphics Simulations." (Research)

19. McQUADE, Peter D., Captain and Instructor

a. "Laser Surface-to-Air Threat Assessment Study." Sponsored by Air Force Center for Studies and Analyses, Washington D.C., August 1986. (Report)

In this classified report I assessed the impact that Soviet Laser Weapons projected for use in 1990-1995 will have on our tactical air operations.

20. MERCIER, Daniel E., Major and Assistant Professor

a. With Captain John F. Anthony, Major Michael L. DeLorenzo, Major Robert S. Fraser (Secretary of the Air Force, SP-6), and Major Robert H. Tate, III. *Handbook of Engineering Fundamentals*. ed. Eshbach. "Astronautics." (Forthcoming Chapter)

We developed a new chapter for Eshbach's fourth edition of *Handbook of Engineering Fundamentals*. The chapter includes Orbital Mechanics with 2-body and n-body motion, space mission planning, guidance, navigation and control, and spacecraft attitude control.

21. NICI, Rosario, Captain and Instructor

a. With Captain Jeffrey W. Hess. "Guessing: Blow it Away with Mega Choice." American Society of Engineering Educators Rocky Mountain Section Meeting, Laramie, WY, 17 April 1986. (Presentation)

See B12a

b. With Captain Jeffrey W. Hess. "Mega Choice Blows Guessing Away." *ACQ*, Vol. VIII, Number 1, 1986. (Article)

See B12b

22. RHOADES, Nancy A., Captain and Instructor

a. With Major Michael L. DeLorenzo, Lt Colonel Jim Durham (DFP), Lt Colonel Douglas H. Kirkpatrick, Captain Dave Lewis (DFP), Major Kent Magnusson (DFB), Captain Jim McBride (50th ATS), Lt Colonel Tom McCloy (DFBL), Captain Mitchell P. Slate, Captain Silvi Steigerwald (DFEE), Major Ralph H. Tate, III., and Lt Colonel John Wood (DFBL). "Space Academics Short Course." July 1986. (Presentation)

See B25a

b. Work in Progress

"Strategic Defense Initiative Sensors and Propulsion." (Research)

23. RHOADS, Harold S., Lt Colonel, Tenure Professor and Deputy Head

a. Work in Progress

"Space Weapons and Politics." (Research)

24. RIGGS, Tom L., Jr., Captain and Assistant Professor

a. "Modeling Continuous-Time Random Processes in Digital Computer Simulations of Physical Systems." Auburn University, Auburn, AL, August 1986. (Dissertation)

I develop and demonstrate the correct functional relationships between continuous noise statistics and discrete noise statistics for application in digital simulations of continuous random processes.

25. SLATE, Mitchell P., Captain and Assistant Professor

a. With Major Michael L. DeLorenzo, Lt Colonel Jim Durham (DFP), Lt Colonel Douglas H. Kirkpatrick, Captain Dave Lewis (DFP), Major Kent Magnusson (DFB), Captain Jim McBride (50th ATS), Lt Colonel Tom McCloy (DFBL), Captain Nancy A. Rhoades, Captain Silvi Steigerwald (DFEE), Major Ralph H. Tate, III., and Lt Colonel John Wood (DFBL). "Space Academics Short Course." July 1986. (Presentation)

We presented a five-week course in astrodynamics, astronomy, navigation, guidance and control, space physiology, propulsion, life support, communications, space physics, and mission planning. The course is geared for aspiring Air Force payload specialists but is offered to all Air Force officers doing space-related work.

b. Work in Progress

"Computer-Aided Instruction for Astrodynamics." (Researach)

26. SVETZ, Holly E., Captain and Assistant Professor

111 a. Work in Progress

"Generic Aircraft Stability and Control Simulator." (Research)

27. TATE, Ralph H., III., Major and Assistant Professor

a. With Captain John F. Anthony, Major Michael L. DeLorenzo, Major Robert S. Fraser (Secretary of the Air Force, SP-6), and Major Daniel E. Mercier. *Handbook of Engineering Fundamentals*. ed. Eshbach. "Astronautics." (Forthcoming Chapter)

See B20a

b. With Major Michael L. DeLorenzo, Lt Colonel Jim Durham (DFP, Lt Colonel Douglas H. Kirkpatrick, Captain Dave Lewis (DFP), Major Ken Magnusson (DFB), Captain Jim McBride (50th ATS), Lt Colonel Tom McCloy (DFBL), Captain Nancy Rhoades, Captain Mitchell P. Slate, Captain Silvi Steigerwald (DFEE), and Lt Colonel John Wood (DFBL). "Space Academics Short Course." July 1986. (Presentation)

See B25a

c. With Captains Martin B. France and M. Scott Trimboli. "Undergraduate Space Training (UST) Program." Sponsored by Space Command, Colorado Springs, CO, July 1986. (Consultation)

See B9b

28. TRIMBOLI, M. Scott, Captain and Assistant Professor

a. With Captain Martin B. France. "Navigation Guidance and Control Curriculum at the Air Force Academy." Annual American Astronautical Society Guidance and Control Conference, Keystone, CO, 1-5 February 1986. (Paper and Presentation)

See B9a

b. With Captain Martin B. France and Major Ralph H. Tate, III. "Undergraduate Space Training (UST) Program." Sponsored by Space Command, Colorado Springs, CO, July 1986. (Consultation)

See B9b

29. VERGEZ, Paul R., Captain and Instructor

a. Work in Progress

"Closed-Loop System Analysis Using Lyapunov Stability." (Dissertation)

30. WERNLE, Kenneth R., Major and Assistant Professor

a. Work in Progress

"Strategic Defense Initiative Launch Systems." (Research)

31. WORSOWICZ, Christopher J., Captain and Assistant Professor

a. With Staff Sergeant Robert M. Humble. "Space Shuttle Flexible Beam Experiment." Sponsored by Space Division and the Air Force Weapons Laboratory. (Paper)

We compile the results of our flexible beam experiment which flew on STS 61-C, 12-18 January 1986. The goal of the experiment was to determine zero-gravity effects on the first harmonic and structural damping of a thin aluminum beam.

CHAPTER C

DEPARTMENT OF BEHAVIORAL SCIENCES AND LEADERSHIP

The mission of the Department of Behavioral Sciences and Leadership is enhanced in many ways by the involvement of faculty members in research. First, we believe that quality instruction requires exposure to the most timely information and central issues of debate within our discipline. Second, an active interest and participation in research sets a desirable standard for our students. Third, we believe that we can greatly improve the cadets' learning experience by providing assistantships in ongoing faculty research projects. Finally, as one of the largest Behavioral Science resources in the Air Force, we are committed to providing research support to Air Force and other DoD agencies across a broad spectrum of topics encompassing personnel decisions, training, leadership, human factors and other Air Force issues. Our involvement in research is one of the strengths of our department and we will continue this emphasis.

1. ANDERSON, John E., Lt Colonel and Tenure Professor

a. With Captain Jeffrey S. Austin. "The Initial Development of the Team Effectiveness Survey." North American Society for Physical Activity and Sports Psychology, Scottsdale, AZ, June 1986. (Conference)

See C3d

2. ARETZ, Anthony J., Captain and Assistant Professor

a. "Expert System Advice: How Should It Be Given?" *Proceedings of the Human Factors Society 30th Annual Meeting*, October 1986: 652-656. (Paper)

I compared three methods of presenting auditory advice to a pilot: automatic, requested, or a combination of both. Automatic presentation of auditory advice proved best.

b. Work in Progress

"Dynamic Task Allocation for Pilot and Computer to Reduce Workload." (Paper)

3. AUSTIN, Jeffrey S., Captain and Associate Professor

a. "Air Officer Commanding Seminar." USAF Academy Air Officer Commanding Workshop, Denver, CO, February 1986. (Conference)

I helped organize and lead a leadership and problem-solving workshop for USAF Academy Air Officer Commanders.

b. "Applied Psychology." Tenth Symposium, Psychology in the Department of Defense, April 1986. (Conference)

I organized and moderated a paper session on new areas in applied psychology. Included in the session were concepts from Lozanov's principles in suggestology, psychological analysis in counter-espionage and new developments in aerospace clinical psychology.

c. "Cadet Commanders Leadership Enrichment Seminar." USAF Academy Cadet Commander's Workshop, Colorado Springs, CO, September 1985 and February 1986. (Conference)

I led the above seminars on general leadership principles for cadet commanders.

d. With Lt Colonel John Anderson. "The Initial Development of the Team Effectiveness Survey." North American Society for Physical Activity and Sports Psychology, Scottsdale, AZ, June 1986. (Conference)

We presented the results of the initial development of an instrument designed to measure the effectiveness of sport teams. The instrument provides consultants and coaches with information that will aid in the improvement of thirteen team dimensions.

e. "Organizational Stressors." Worldwide Dietitians Management Conference, Sheppard AFB, TX, April 1986. (Presentation)

I reported data generated by an organizational survey to help identify organization-wide stressors affecting the USAF dietitians. Several coping strategies were suggested.

f. "Preventing Professional Burnout." 18th Annual Physical and Occupational Management Conference, Sheppard AFB, TX, October 1985. (Presentation)

I covered research data on occupational and physical therapists and suggested organizational and personal methods for correcting issues that were causing stress and burnout within those career fields.

g. "Stress in Long Duration Space Flight." National Aeronautical Space Administration, Houston, TX, April 1986. (Presentation)

I discussed four basic models of stress along with stress reduction techniques that may be appropriate for long duration space flight.

h. With Major Jose Bolton. "The Use of Exercise as a Stress Reducer in Long Duration Space Flight." *Proceedings, Psychology in the Department of Defense, Tenth Symposium*, USAFA-TR-86-1, April 1986. (Paper)

We discussed various models of stress reduction and exercise as a method for coping with stress.

4. BOLTON, Jose, Major and Assistant Professor

a. With Captain Jeffrey S. Austin. "The Use of Exercise as a Stress Reducer in Long Duration Space Flight." *Proceedings, Psychology in the Department of Defense, Tenth Symposium*, USAFA-TR-86-1, April 1986. (Paper)

See C3h

5. BURON, Raoul J., Jr., Major and Instructor

a. "Cadet Commanders Leadership Enrichment Seminar." USAF Academy Cadet Commanders Workshop, Colorado Springs, CO, August-November 1986. (Conference)

I discussed effective communication, conflict management, delegation, perception, team building, and leadership.

b. "Clinical Biofeedback." The Menninger Foundation, Topeka, KS, September 1986. (Workshop)

c. "The Use of Christian Teachings in Existential Psychotherapy." Department of Counseling Psychology, University of Southern California, Los Angeles, CA, June 1986. (Paper)

I examined the philosophies of Christianity and existentialism, discussing how Christian teachings are useful in existential psychotherapy.

d. "Skills Training Program." USAF Academy Cadet Counseling Center, Colorado Springs, CO, January-April 1986. (Workshop)

We designed a four-month program to help cadets improve poor interpersonal skills which have contributed to their being placed on Aptitude Probation.

e. Work In Progress

"Flight Training Anxiety Relief." (Consultation)

"Impact of Day-to-Day Stressors and Public Image on the Professionalism of USAF Academy Security Police." (Consultation)

6. CLOVER, William H., Lt Colonel and Tenure Associate Professor

a. "Air Officer Commanding Seminar." USAF Academy Air Officer Commanding Workshop, Denver, CO, February 1986. (Conference)

I helped organize and lead a leadership and problem-solving workshop for USAF Academy Air Officer Commanders.

b. With Lt Colonels Thomas McCloy and Frank Wood. "Stability of Perceived Job Characteristics Among U.S. Air Force Security Guards." 94th Annual Convention of the American Psychological Association, Washington D.C., August 1986. (Presentation)

See C17g

c. With Lt Colonel Frank Wood. "Fraternization: The New Corporate Incest." *The United States Air Force Academy Journal of Professional Military Ethics*, 1985. (Article)

See C17e

7. FALLON, Gail A. Captain and Instructor

a. Work in Progress

"Computers in the Classroom: Using the Microcomputer as an Instructor Tool."

"The Social and Academic Impact of Microcomputers in the Dorms (MIDs) at the USAF Academy." (Paper)

8. GINNETT, Robert C., Lt Colonel and Assistant Professor

a. "Airline Crews as Production Teams." 94th Annual Convention of the American Psychological Association, Washington D.C., August 1986. (Presentation)

I presented a paper examining the work of airline flight crews. I pointed out that because of standardization of procedures, high training coupled and low deviations, the performance of flight crews is in many ways similar to other production oriented work groups.

b. With Professor J. Richard Hackman (Harvard University). "Groups Who Fly." Yale University, New Haven, CT, November 1985. (Colloquium)

We examined the underlying psychological dimensions of crew work in aviation cockpits. In particular, we analyzed the work in terms of other established group psychological paradigms.

c. "Leadership and Management Across Cultures: Considerations for NATO Executives." Kassel, Germany, March 1986. (Presentation)

This presentation was tailored specifically for senior NATO officials who must operate daily in a cross-cultural environment. It included many of the traditional approaches to leadership and management, stressing the known impact of varied cultures on these theories.

d. "Okay, Let's Brief Real Quick: The Group Formation Process of Airline Flight Crews." 46th Annual Meeting of the Academy of Management, Chicago, IL, August 1986. (Paper and Presentation)

I presented one of a series of four papers examining the traditional models of ordered group process. This particular paper suggested that much of the important information about how a group is to work together is transmitted in the first few moments of the groups' formation.

e. "Productivity Programs, Problems and Potential Research in the United States Air Force." *Technical Report*, AFHRL-TP-85-10. Air Force Human Research Laboratory, Brooks AFB, TX, March 1986. (Technical Report)

I examined the numerous behavioral science efforts to enhance productivity in the Air Force, concluding that these efforts had been ephemeral, even though their potential had been reasonably well-documented both in the military and in the private sector.

f. "Rational and Irrational Leadership Concepts." Western Federal Executive Center, Denver, CO, September 1986.

This presentation for Senior Executive Service selectees was designed to expand the overbounded rational approach in which most of them had come to operate. It suggested that some irrational models of behavior had potential for transactional leadership.

g. Work in Progress

"First Encounters of Close Kind: The First Meeting of Airline Flight Crews." (Dissertation)

"Airline Cockpit Crew" in *Groups that Work*. (Chapter)

9. GREGORY, Robert A., Lt Colonel and Tenure Associate Professor

a. "Education for Student Leadership: Fostering Development of Skills and Values." American Association of Higher Education National Conference, Washington, D.C., March 1986. (Conference)

I discussed the results of a recent study of trends in the teaching of leadership in higher education. The study results indicate that there are a large number of diverse leadership programs being offered in colleges and universities.

b. "Is the White Male Club Alive and Well in the Military?" White American Symposium, Defense Equal Opportunitity Management Institute, Patrick AFB, FL, March 1986. (Symposium)

The presentation and panel discussion dealt with the issue of the white majority within the military. The proportions of minority members and their distributions, as well as various measures of success, were also discussed.

c. With Frank H. Freeman and Miriam B. Clark. *Leadership Education: A Source Book*. Center for Creative Leadership, Greensboro, NC, 1986. (Book)

The book is a compilation of selected leadership resources available to those who are either involved in, or planning a course with a focus on leadership. Approximately fifty course syllabi or detailed program descriptions are included as well as an extensive annotated bibliography of leadership literature, an annotated film list with sources, a list of individuals involved with leadership training, and selected documents that should prove helpful to the intended audience.

d. "Leadership Education/Instruction/Training in Higher Education." Leadership Education Conference, Center for Creative Leadership, Greensboro, NC, July 1986. (Presentation)

I assisted in planning and conducting a leadership education conference attended primarily by leadership educators and college and university administrators interested in the development of leadership skills among their students. As a part of the conference, I presented a compilation of the results of an extensive survey of programs of leadership instruction in higher education.

e. "Leadership: Methods of Development in Higher Education." North Carolina Fellows Program, North Carolina State University, Raleigh, NC, April 1986. (Presentation)

I discussed the topic of leadership, and the various methods used by colleges and universities to develop leadership, with North Carolina Fellows. Particular emphasis was given to the methods used at the USAF Academy.

f. With William E. Rosenbach (Gettysburg College). "Longitudinal Study of Air Force Pilots' Job Attitudes." 94th Annual Convention of the American Psychological Association, Washington D.C., August 1986. (Presentation)

We presented the results of studies done 1979, 1982, and 1984 on the attitudes of Air Force pilots. Particular emphasis was given to attrition trends in the younger pilots and the relationships between job attitudes and attrition.

g. "A Longitudinal Study of the Job Attitudes of U.S. Air Force Pilots: Revisited." *Proceedings, Psychology in the Department of Defense, Tenth Symposium*, USAFA-TR-86-1, April 1986. (Paper)

The paper summarizes the results of surveys of Air Force pilots' job attitudes. Particular emphasis was given to differences among subgroups based on grade and command.

h. "Psychology at the U.S. Air Force Academy." 94th Annual Convention of the American Psychological Association, Washington, D.C., August 1986. (Conference)

As a member of a panel on the teaching of psychology at the military academies, I gave a broad overview of the Department of Behavioral Sciences and Leadership and the Air Force Academy.

i. "Student Leadership Development Programs: Establishing Dimensions for the Future." American College Personnel Association Annual Convention, New Orleans, LA, April 1986. (Workshop)

As part of a pre-convention workshop primarily attended by college and university student personnel administrators, I presented selected research findings from a study I conducted on leadership programs found in high education.

10. JAEGER, Bruce R., Major and Instructor

a. "The Effects of Local Exertion and Anticipation on the Performance of a Discrete Skill." North Carolina State University, Raleigh, NC, May 1986. (Dissertation)

I studied local physical work (arm exercise) and its effects on ongoing mental and physical skills. As work became heavier, arm skill dropped but no effect on decision-making or timing was found.

11. McCLOY, Thomas M., Lt Colonel and Tenure Associate Professor

a. With Lt Colonel William Derrick (Center for Creative Leadership). "Behavioral Workload Assessment Techniques." Department of Defense Human Factors Engineering Technical Advisory Group Workload Workshop, Dayton, OH, September 1986. (Presentation)

We presented a tutorial on current theory and techniques for the application of behavioral measures to workload assessment.

b. With Lt Colonel William Derrick (Center for Creative Leadership). "The Effect of Spatial Ability on the Demand for Spatial Processing Resources." *Proceedings of the 30th Annual Meeting of the Human Factors Society*, Dayton, OH, September 1986, 624-627. (Paper)

We addressed the relationship between spatial ability (as defined by paper and pencil tests and spatial resources required for psychomotor task performance.

c. "Human Factors Design Issues in Space Operations." Space Operations Short Course. USAF Academy, Colorado Springs, CO, August 1986. (Presentation)

I discussed ten different human factors design considerations for long-duration space flight.

d. With Lt Colonels William Clover and Frank Wood. "Stability of Perceived Job Characteristics Among U.S. Air Force Security Guards." 94th Annual Convention of the American Psychological Association, Washington, D.C., August 1986. (Presentation)

See C17g

e. Work in Progress

"The Impact of Shiftwork on Nuclear Weapon Security Guard Performance." (Consultation)

"Institutional and Occupational Trends in Academy Education."(Chapter)

12. PATTON, Mark W., Captain and Instructor

a. Work in Progress

"The Impact of Shiftwork on Nuclear Weapon Security Guard Performance." (Consultation)

"Factors Affecting Career Decisions of Women in the USAF Academy Class of 1980." (Paper)

13. PORTER, David B., Major and Assistant Professor

a. "Cognitive Psychology and the Myth of Intelligence." Oxford Chapter of MENSA, Wolfson College, Oxford, England, June 1986. (Presentation)

I provided a brief historical account of the concept of intelligence, then an overiew of contemporary cognitive psychology. Certain key assumptions underlying intelligence measurement were refuted by empirical evidence.

b. Differential Effects of Articulatory Suppression and Randomization on the Performance of Different Aspects of a Computer Game." *Proceedings, Psychology in the Department of Defense, Tenth Symposium*, USAFA-TR-86-1, April 1986. (Paper)

Although a very demanding verbal side task interfered equally with both aspects of a computer game, after thirty minutes of practice the more complex task was unaffected by the side task. Performance of the simple but uncertain task continued to show the disruptive effects of the side task, however.

c. "Differential Effects of Memory Load on the Performance of Substantively Different Aspects of a Computer Game." *Proceedings, Psychology in the Department of Defense, Tenth Symposium*, USAFA-TR-86-1, April 1986. (Paper)

Subjects' performance of a complex, arcade-type video game showed that increases in a concurrent verbal memory task interfered with a simple but uncertain task, but had no effect on the performance of a complex but certain task.

d. With D.E. Broadbent and A.J. Tattersall (both of Oxford University). "Effects of Stimulus Quality and Priority Manipulations on Dual Task Performance." *Proceedings, Psychology in the Department of Defense, Tenth Symposium*, USAFA-TR-86-1, April 1986. (Paper)

We compared two types of stimulus degradation. The lack of interaction between priority tradeoff supported a multiple resource information processing model.

e. "A Functional Examination of Intermediate Cognitive Processes." Oxford University, England, May 1986. (Dissertation)

I explore the functional characteristics of those mental processes which occur between the acquisition of representation and the execution of responses. A theoretical dual process model, explanation of analytic techniques, and five experiments are included.

f. With D.C. Berry, D.E. Broadbent, and N. Hayes (all of Oxford University). "Implicit and Explicit Knowledge." Annual Meeting of the Experimental Psychological Society, London, England, January 1986. (Presentation)

We presented convergent evidence from a variety of experiments supporting the view that implicit and explicit knowledge were functionally separated memory systems with independent influences on human performance.

g. "Task Characteristics and Human Information Processing." Human Experimental Group, Oxford University, England, October 1985. (Presentation)

I presented a theoretical model of the human information processing system. Task complexity and uncertainty were assumed to be independent dimensions. Evidence from dual task experiments supported the distinction.

h. "The Things People Say About the Games They Play." Social Psychological Seminar Series, Oxford University, England, May 1986. (Presentation)

I presented evidence from my experiments with computer games and verbal side tasks to argue that verbal accounts of complex tasks may be considerably different from actual behavior. Social psychological implications were then discussed.

i. Work in Progress

"Computer Games and Cognitive Processes." (Paper)

"The Deleterious Effects of Explanation on Complex Judgments." (Paper)

"Using Signal Detection Theory to Explore Verbal Memory." (Paper)

14. SCHOEN, Robert J., Major and Instructor

a. With Dr. Peter Johnson (University of New Mexico). "Use of Disjunctive Response Requirements in Dual Task Environments: Implications for Automation." University of New Mexico, Albuquerque, NM, May 1986. (Dissertation)

I assessed the difference in resource requirements for choice and disjunctive (Donders' Type C) responding in a dual task scenario. Disjunctive responding proved both faster and less error-prone than choice responding while also improving concurrent task performance. Results were described in terms of use within semiautomated environments.

15. WILLIAMS, Michael S., Captain and Instructor

a. Work in Progress

"Air Force Organizational Structures." (Consultation)

"Effects of Shiftwork on the Nuclear Weapon Secrity Guard Performance." (Paper)

"Factors Affecting Career Decisions of Wormen in the USAF Academy Class of 1980." (Paper)

16. WINSTEAD, Charles L., Major and Instructor

a. With Lt Colonel G.R. Sessions (Army Research and Development), Kathryn H. Chantry (University of Colorado), Charles Bakhit and George F. Koob (Scripps Clinic and Research Foundation). "Effects of Nucleaus Basalis Lesions on General Activity in the Rat." *Proceedings, Psychology in the Department of Defense, Tenth Symposium*, USAFA-TR-86-1, April 1986. (Paper)

We attempted to develop an animal model for the study of Alzheimer's disease. We measured the general activity levels of subject rats when their levels of somatostatin were depleted. We found a general increase in levels of locomotive behavior of the subject rats.

b. Work in Progress

"Behavioral Activation Following Centrally Administered Cysteamine HCL: An Endogenous Effect of Somatostatin Release." (Paper)

17. WOOD, Frank R., Lt Colonel and Associate Professor

a. "Air Officer Commanding Seminar." USAF Academy Air Officer Commanding Workshop, Denver, CO, February 1986. (Conference)

I helped organize and lead a leadership and problem-solving workshop for USAF Academy Air Officer Commanders.

b. "Behavioral Considerations for Space Station Design." *USAFA Technical Report 86-3*, 1986. (Technical Report)

I discussed design considerations for the human subsystem in space operations.

c. "Cadet Commanders Leadership Enrichment Seminar." USAF Academy Cadet Commanders' Workshop, Colorado Springs, CO, September 1985 and February 1986. (Conference)

I led seminars on leadership and problem-solving for cadet commanders.

d. "A Critical Evaluation of Competition at the Air Force Academy in 1980." *USAFA Technical Report*, USAFA-TR-86-4, 1986. (Technical Report)

I wrote an in-depth examination of the competitive system affecting USAF Academy cadets in 1980 and proposed changes to the system.

e. With Lt Colonel William Clover. "Fraternization: The New Corporate Incest." *The United States Air Force Academy Journal of Professional Ethics*, 1985. (Article)

We redefined fraternization in the military, emphasizing the impact on organizational effectiveness.

f. "F-16 Flight Commander Leadership Seminar." 474th Tactical Fighter Wing, Nellis AFB, NV, April 1986. (Presentation)

I presented a leadership and problem-solving seminar for new F-16 flight commanders and their spouses.

g. With Lt Colonels William Clover and Thomas McCloy. "Stability of Perceived Job Characteristics Among U.S. Air Force Security Guards." 94th Annual Convention of the American Psychological Association, Washington, D.C., August 1986. (Presentation)

We challenged the notion that perceived job characteristics are stable across different locations and times.

h. Work in Progress

The Military: More Than 'Just a Job'. (Book)

"The Effects of Shiftwork on Nuclear Weapon Security Guards." (Paper)

CHAPTER D

DEPARTMENT OF BIOLOGY

The Department of Biology is committed to a strong and viable research effort. We believe this for the following reasons: first, the very essence of any science is to perform research by investigating unknown areas. It is only through this exercise that we push back the limits of ignorance and expand upon the knowledge of man. Second, research provides our instructors the opportunity to retain academic competence in a rapidly changing science. Third, our research projects frequently are directed at solving specific Air Force related problems such as: the physiology of manned space flight, toxicology of hazardous materials, the effects of hyperbaric oxygen treatment, and the management of the environment. Finally, through our Biology 499 Independent Study Courses, cadets have the opportunity to participate in many of these research activities for academic credit as well as scientific development.

1. ANDREWS, J. David, Captain and Assistant Professor

a. Work in Progress

"Induction of Hibernation in Small Mammals."(Research)

2. BIEVER, Lawrence J., Lt Colonel and Tenure Professor

a. With Majors James L. Brickell (DFCE), Harold C. Manson (DFL) and Russell T. Roth (DFE), and Captains Mark A. Hamilton (DFC), Jefferey L. Larson (DFPS) and Jay L. Lorenzen (DFPS). "United States Air Force Environmental Policy at United States Air Forces in Europe Installations." Sponsored by Headquarters, United States Air Force, Environmental Division, Directorate of Engineering and Services; Headquarters, United States Air Forces in Europe, Directorate of Planning and Programming; Office of the Secretary of the Air Force, Deputy for Environment, Safety, and Occupational Health; and Headquarters, United States Air Force Academy, Dean of Faculty. Conducted at the United States Air Force Academy, CO, 5 May-23 June 1986 and at Headquarters, United States Air Forces in Europe, Ramstein AFB, Germany, 25 May 1986-1 October 1986. (Consultation)

This interdisciplinary study developed environmental policy, plans, and strategies which will enhance, or prevent the degradation of, the United States Air Force mission in Europe. The goal is to avoid environmental and occupational health incidents which degrade operational readiness or which have negative political or legal consequences, and to minimize future liabilities from litigation, compensation, and installation recovery.

3. FISHER, Alan R., Captain and Assistant Professor

a. With Captain Robert C. Kull, Jr. "Effects of Supersonic and Subsonic Aircraft Noise on Animals: A Literature Review." Sponsored by the Noise and Sonic Boom Impact Technology Program, Arnold Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH, 30 September 1986. (Literature Review and Consultation)

See D4a

b. Work in Progress

"Breeding and Winter Bird Surveys of the United States Air Force Academy." (Report)

4. KULL, Robert C., Jr., Captain and Instructor

a. With Captain Alan R. Fisher. "Effects of Supersonic and Subsonic Aircraft Noise on Animals: A Literature Review." Sponsored by the Noise and Sonic Boom Impact Technology Program, Arnold Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH, 30 September 1986. (Literature Review and Consultation)

We analyzed the literature on the effects of supersonic and subsonic noise on wildlife. Once the specific literature citings were identified, we attempted to determine the technological gaps and made recommendations to the Air Force for filling those gaps based on known Air Force requirements.

5. RIPLEY, J. Douglas, Lt Colonel and Associate Professor

a. "Current Developments in Plant Biotechnology."(Sponsored by the Defense Intelligence Agency, Washington, D.C.) ARCO-University of California, Los Angeles Symposium on Molecular Biology of Plant Growth Control, Lake Tahoe, CA, 24-28 February 1986. (Report)

I summarized the presentations given at the symposium for the Defense Intelligence Agency.

b. "Current Biotechnology Applications in Agriculture." (Sponsored by the Defense Intelligence Agency, Washington, D.C.) ARCO-University of California, Los Angeles Symposium on Molecular Biology of Plant Growth Control, Lake Tahoe, CA, 24-28 February 1986. (Report)

I summarized the presentations given at the symposium for the Defense Intelligence Agency.

c. Work in Progress

"Floristic Survey of the United States Air Force Academy Reservation." (Report)

6. SAMPSON, Orwyn, Colonel and Permanent Professor

a. "The Assessment of Body Composition: A Review." National Aeronautics and Space Administration, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, JPL D-3431, May 1986. (Report)

I review methods used to assess body composition, including a discussion of the importance of these assessments and an evaluation of the accuracy and precision of various methods.

b. With D.M. Freeman, P.L. Lee and B.D. Ross (All of the National Aeronautics and Space Administration, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA). "Measurement of Body Fat/Water Ratio by Magnetic Resonance Spectroscopy and Magnetic Resonance Imaging." Society of Magnetic Resonance in Medicine, Fifth Annual Meeting, Montreal, Canada, 18-22 August 1986. (Poster Presentation)

We presented the results of studies done using nuclear magnetic resonance techniques on human tissue.

c. "Some Observations Concerning Muscle, Fat, and Bone with Implications for Body Composition Research." National Aeronautics and Space Administration, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, JPL D-3466, June 1986. (Report)

I reviewed the characteristics of three major body components concerning the mass of these components and factors that affect their mass producing atrophy and hypertrophy.

7. SCHELHAAS, Douglas P., Lt Colonel and Assistant Professor

a. "Antifreeze Production and Cold-tolerance in Overwintering Purple Martin Fleas, *Ceratophyllus idius* Jordan and Rothschild." University of North Dakota, Grand Forks, ND, 1986. (Dissertation)

I studied the types of biological antifreezes produced, the environmental stimuli that trigger snythesis of these antifreezes, their metabolic source and the extent to which they produce cold-tolerance in the insect.

b. With Dr. O.R. Larson (University of North Dakota). "Effect of Temperture on Regulation of Glycerol Levels in Cold-Hardened Purple Martin Fleas, *Ceratophyllus idius.*" *Proceedings of the North Dakota Academy of Science*, Volume 40, page 68, April 1986. (Presentation and Article)

We presented evidence for a reversible temperature-dependent mechanism that controls glycerol levels in this insect.

c. With Dr. O.R. Larson (University of North Dakota). "Glycogen and Glycerol in the Cryoprotection of Purple Martin Fleas, *Ceratophyllus idius.*" Annual Meeting of the Midwest Conference of Parasitologists, University of Missouri, Columbia MO, 7 June 1986. (Presentation)

We presented evidence that glycogen is the metabolic precursor for glycerol synthesis in this insect.

d. Work in Progress

With Dr. O.R. Larson (University of North Dakota). "Mechanisms of Cryoprotection in the Purple Martin Flea, *Ceratophyllus idius.*" (Article)

8. SHIELDS, George I., Major and Assistant Professor

a. With Dennis Brown and Lelio Orci (both of the University of Geneva Medical Center, Switzerland), Heinz Valtin (Dartmouth College Medical School), and John F. Morris (Oxford University, England). "Lack of Intramembranous Particle Clusters in Collecting Ducts of Mice with Nephrogenic Diabetes Insipidus." *American Journal of Physiology*, Volume 249, pages F582-F589, 1985. (Article)

We show that the collecting duct cells of mice with severe nephrogenic diabetes insipidus do not have intramembranous particles, which, in other membrane systems, are a morphological marker for increased water permeability. Further, neither endogenous nor exogenous vasopressin can increase water permeability of medullary collecting ducts in these animals.

9. TILLINGHAST, Henry S., Jr., Major and Associate Professor

a. Work in Progress

With P.C. Newell (University of Oxford, England). "Chemotaxis Towards Pteridines during Development of *Dictyostelium.*" *Journal of Cell Science.* (Article)

10. TOOLE, Joseph E., Major and Assistant Professor

a. Work in Progress

"*Spirometra Mansonoides*: Tegumentary Profile Associated with Multiple Paratenicity." (Dissertation)

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CHAPTER E

DEPARTMENT OF CHEMISTRY

The Department of Chemistry is committed to three major research objectives: maintaining and improving the professional excellence and expertise of our faculty, providing opportunities for chemistry majors to engage in meaningful research in the senior chemistry course, and contributing to the technology base of Air Force research and development. We attempt to get our people involved in one form of research or another to stay current in the rapidly changing field of chemistry. Each year we provide ongoing research projects--ranging from laser research to organic synthesis--for several Chemistry 499 students. A large portion of our research is in support of the Frank J. Seiler Research Laboratory (FJSRL) of Air Force Systems Command. FJSRL personnel provided ongoing projects suitable for involvement on a part-time basis.

1. AVILA, Walter B., Major and Tenure Associate Professor

a. With Major M.E. Braydich, M.E. Key (St. Albans High School), J. Lieberman (T.C. Williams Sr. High School), Captain P.D. Summer. III., and Lt Colonel J.R. Wright. "XVII International Chemistry Olympiad Study Camp." USAFA, Colorado Springs, CO, June 1986. (Conference)

This was a two-week study camp and final competition to select the four-member team to represent the United States at the international competition in Leiden, The Netherlands.

b. "XVII International Chemistry Olympiad." Leiden, the Netherlands, 6-15 July 1986. (Consultation)

I was selected by the American Chemical Society as a mentor for the United States team. We trained the top twenty high school chemistry students from the U.S. and selected the four members of the U.S. team. I continued as a delegate from the U.S. and helped run the international competition.

c. With Cadet First Class P.A. Whelan. "Friedel-Crafts Acylation - A New Method." United States Air Force Academy Department of Chemistry Research: AY 1984-1985, USAFA-TR, in preparation. (Technical Report)

Work related to the title was summarized in the department technical report.

d. With Cadet First Class K.K. Knight and Major D.M. Storch. "MNDO Calculations Directed Towards the Synthesis of Hexanitrotolanes." Colorado Undergraduate Research Symposium, University of Denver, Denver, CO, 19 April 1986. (Presentation)

Cadet Knight presented results of his Chemistry 499 research project. His presentation was judged best at the symposium.

e. With Dr. N. Heimer (Frank J. Seiler Research Laboratory/AFOSR). "Regiospecific Fluorinations of Aryl Anions With Xenon Difluoride." United States Air Force Academy Department of Chemistry Research: AY 1984-1985, USAFA-TR, in preparation. (Technical Report)

Work under this title was summarized in the department technical report.

f. With M.D. Hampton (University of Central Florida), M.E. Key (St. Albans High School), Captain P.D. Summer, III., and Lt Colonel J.R. Wright. "U.S. Chemistry Olympiad Program: Participation and Current Development." Eighth American Chemical Society Rocky Mountain Regional Meeting, Denver, CO, 10 June 1986. (Presentation)

See E13b

g. With M.E. Key (St. Albans High School), Captain P.D. Summer, III., and Lt Colonel J.R. Wright. "U.S. Chemistry Olympiad Program: Participation and Current Development." 192nd National American Chemistry Society Meeting, Anaheim, CA, 7-12 September 1986. (Presentation)

We presented results of the U.S. team competition in the International Chemistry Olympiad. The U.S. team won a gold, silver, and bronze medal.

h. Work in Progress

"Development and Testing of New Acylating Agents." (Research)

"Synthesis of Polynitrophenyl Acetones." (Research)

"Development of New Micro Organic Laboratory Experiments." (Research)

2. BRAYDICH, Michael E., Major and Associate Professor

a. With Major W.B. Avila, M.E. Key (St. Albans High School), J. Lieberman (T.C. Williams Sr. High School), Captain P.D. Summer, III., and Lt Colonel J.R. Wright. "XVII International Chemistry Olympiad Study Camp." USAFA, Colorado Springs, CO, June 1986. (Conference)

See E1a

b. Work in Progress

"Microscale Experiments to Teach Chemistry." (Research)

3. FIFE, Dennis J., Lt Colonel and Associate Professor

a. With Dr. W.M. Moore and Dr. K.W. Morse (both of Utah State University). "Photosensitized Isomerization of Norbornadiene to Qudricyclane with (Arylphosphine) Copper (I) Halides." *Journal of American Chemical Society*, 107, 7077 (1985). (Article)

We showed that Arylphosphine Copper (I) halides are effective sensitizers for the norbornadiene/quadriclyclane system. We proposed the photoisomerization of norbornadiene to quadricyclane as a solar energy storage system.

b. With Dr. W.M.Moore and Dr. K.W. Morse (both of Utah State University). "Photosensitized Isomerization of Norbornadiene to Quadricyclane with (Arylphosphine) Copper (I) Halides." 37th Pittsburgh Conference Exposition, Atlantic City, NJ, March 1986. (Conference)

I presented the data from the article described in E3a at this conference.

c. With Dr. W.M. Moore and K.W. Morse (both of Utah State University). "Photosensitized Isomerization of Norbornadiene to Quadricyclane with (Arylphosphine) Copper (I) Halides." 39th Annual Summer Symposium on Analytical Chemistry, University of Utah, Salt Lake City, UT, 18-20 June 1986. (Conference)

I presented the data from the article described in E3a at this conference.

d. Work in Progress

"Photochemical Reactions Induced by Solar Radiation for a Storable High Energy Product." (Research)

4. HILDRETH, Robert A., Major and Assistant Professor

a. With Captain J.A. Fryling, Dr. R.L. McKenney, Jr., and Mr. S.R. Struck (all of Air Force Armament Laboratory). "Synthesis and Properties of Selected Energetic Organodi- and Polyammonium Nitrate Salts." Air Force Armament Laboratory, (AFATL) TR-86-08, April 1986. (Technical Report)

Selected organodi- and polyammonium nitrate salts were sythesized and characterized for use in a qualitative study of thermal and impact stability characteristics. A total of twenty-two salts were prepared, fifteen of which had not been reported and were assumed to be original. The densities (both calculated and measured), heats of fusion, melting points and the exotherm decomposition temperatures were determined for all compounds.

b. With Lieutenant J.L. Andreshak, Dr. R.D. Chapman, Lieutenant S.P. Herrlinger (all of Air Force Rocket Propulsion Laboratory), Major S.A. Shackelford (European Office of Aerospace Research and Development), and Lieutenant J.P. Smith (formerly of Frank J. Seiler Research Laboratory). "Trifluoromethanesulfonate Esters from Dibromoalkane Metathesis with Silver Triflate: Mechanistic and Synthetic Aspects." *Journal of Organic Chemistry*, 51 (1986). (Article)

The metathesis reaction between silver triflate and bromoalkanes potentially offers an attractive synthetic complement to the well-known alcohol condensation with triflic anhydride for organic triflate esters. Dibromoalkanes can further give difunctional triflate intermediates and could provide convenient routes to asymmetrically substituted derivatives. We explained the mechanistic aspects by evaluating the effects of temperature, solvent choice and alkyl chain length on the reactivity and selectivity of reaction of mono- and dibromoalkanes with silver triflate.

5. KILLPACK, Michael O., Captain and Instructor

a. With Professor D.L. Comins (Utah State University). "Metalation of Heterocyclic Aromatic Aldehydes." Utah State University, Logan, UT, December 1985. (Thesis)

The addition of certain lithiated secondary amines to various heteroaromatic aldehydes forms -amino alkoxides, which are stable to substitution by lithium reagents. The resulting -amino alkoxide is used as both an aldehyde protecting group and as a directing group for ring-lithiation. The -amino alkoxides are metalated with alkyllithium, alkylated, and hydrolyzed to provide substituted heterocyclic aldehydes via one-pot reactions. I discuss the ability to vary the site of metalation on the heteroaromatic ring by changing the amine component of the -amino alkoxide from the strong ortho directing N,N,N'-trimethyl-ethylenediamine to the much weaker coordinating N-methylpiperazinc.

6. MEYER, Howard R., Jr., Captain and Assistant Professor

a. Work in Progress

"Quantitative Determination of UO_2^{2+} Using the Quartz Crystal Microbalance." (Research)

7. MUEH, Hans J., Lt Colonel, Tenure Proessor and Department Head

a. Work in Progress

"Technology Assessment for DOD." (Consultation)

8. NOETZEL, Jonathan C., Major and Assistant Professor

a. With Major D.M. Storch and Captain L.D. Strawser. "Computer-Aided Instruction in the Department of Chemistry at the U.S. Air Force Academy." American Chemical Society Meeting, Denver, CO, 8-12 June 1986. (Presentation)

See E12d

b. With Captains L.D. Strawser and G.W. Tessmer. "Computer-Managed Instruction in the Department of Chemistry at the U.S. Air Force Academy." Eighth Rocky Mountain Regional Meeting, American Chemical Society, Denver, CO, 10 June 1986. (Presentation)

I presented the CMI system which the chemistry department uses to manage one of the largest first-year courses at the academy.

9. RACHOCKI, Kenneth D., Captain and Instructor

a. With Cadet First Class M.A. Pipan. "Auger Analysis of Lithium Electrodes for Molten Salt Cells." Joint Symposium of the American Vacuum Society and the Society of Electron Microscopists, Denver Marriott Southeast, Denver, Co, 8 May 1986. (Presentation)

Lithium electrodes placed in 0.33 mole fraction AlCl solution in Methyethylimidazolium Chloride (MEICl) were found to lose mass, while those in a 0.50 solution gained weight. Auger electron spectroscopy of the samples showed the presence of chlorine, aluminum, fluorine, nitrogen and a number of adventitious contaminants. Careful analysis of the data indicates that several net reactions may take place.

b. With Cadet First Class M.A. Pipan. "Unexpected Variations in the Auger Yield with Beam Energy." Joint Symposium of the American Vacuum Society and the Society of Electron Microscopists, Denver Marriott Southeast, Denver, CO, 8 May 1986. (Presentation)

We presented a summary of the variations to the research discussed in E9a.

c. Work in Progress

With Lt Colonel C.J. Dymek, L. Pflug (both of Frank J. Seiler Research Laboratory/AFOSR), and Cadet First Class M.A. Pipan. "Auger Analysis of Lithium Electrodes for Molten Salt Cells." (Research)

10. SONOBE, Blake I., Lt Colonel and Associate Professor

a. With Cadet First Class P.M. Benson. "The Photochemistry of Tropone." Colorado Undergraduate Research Symposium, sponsored by the American Chemical Society, University of Denver, Denver, CO, 19 April 1986. (Presentation)

We presented the results of our study on the photofragmentation mechanism of tropone. Our results indicate a different mechanism than assumed, based on previous research. Theoretical calculations were also completed for this reaction.

11. STORCH, Donn M., Major and Associate Professor

a. With Dr. J.J.P. Stewart (Frank J. Seiler Research Laboratory/AFOSR). "Computational Chemical Approaches to Properties of Polymers." Air Force Materials Laboratory, Wright-Patterson AFB, Dayton, OH, 27-29 April 1986. (Consultation)

Dr. Stewart and I installed state-of-the-art theoretical chemical programs on Cray X-MP and VAX computers at the Laboratory. We trained some of the lab personnel on methods of study using computational chemical tools.

b. With Dr. J.J.P. Stewart (Frank J. Seiler Research Laboratory/AFOSR) and Captain L.D. Strawser. "Computational Studies of Enzyme Catalysis." First Gordon Research Conference or Computational Chemistry, New London, NH, 4-8 August 1986. (Presentation)

See E12C

c. With Captains J.C. Noetzel and L.D. Strawser. "Computer-Aided Instruction in the Department of Chemistry at the U.S. Air Force Academy." American Chemical Society Meeting, Denver, CO, 8-12 June 1986. (Presentation)

See E12d

d. With Dr. J.J.P. Stewart (Frank J. Seiler Research Laboratory/AFOSR) and Captain L.D. Strawser. "Mechanism of Alpha-Chymotrypsin Catalysis Using Semi-Empirical Methods." Cray Research, Inc, Mendota Heights, MN, 26 July 1986. (Presentation)

Dr. Stewart presented our quantum mechanical calculations of alpha-chymotrypsin, which were performed on Cray XMP Supercomputers.

e. With Dr. J.J.P. Stewart (Frank J. Seiler Research Laboratory/AFOSR) and Captain L.D. Strawser. "Mechanism of Alpha-Chymotrypsin Catalysis Using Semi-Empirical Methods." *Proceedings of the First Symposium on Computational Chemistry on Cray Supercomputers*, Cray Research, Inc., Mendota Heights, MN. (Forthcoming Article)

We recorded the proceedings of the conference where Dr. Stewart presented results of our calculations of alpha-chymotrypsin, which we performed on Cray XMP Supercomputers.

f. With Major W.B. Avila and Cadet First Class K.K. Knight. "MNDO Calculations Directed Towards the Synthesis of Hexanitrotolanes." Colorado Undergraduate Research Symposium, University of Denver, Denver, CO, 19 April 1986. (Presentation)

See E1d

g. With Major L.P. Davis (Air Force Office of Scientific Research) and Captain L.D. Strawser. "Physical Chemistry at USAFA: Personalized Instruction." (Forthcoming Article)

We describe the development of a personalized instruction method to teach physical chemistry. We discuss the topics taught from the perspective of the history of physical chemistry at USAFA. We also describe the specialized computer program developed by one of the authors to evaluate the mastery level of each cadet and to manage each cadet's progress through the course. Finally, we describe the results of using this instructional style for two years.

h. With Dr. J.J.P. Stewart (Frank J. Seiler Research Laboratory/AFOSR) and Captain L.D. Strawser. "Theoretical Studies of the Active Site of Alpha-chymotrypsin." 26th Sanibel Symposium, Marineland, FL, 6-15 March 1986. (Presentation)

See E12k

i. Work in Progress

"Calculation of Enzyme Properties on Supercomputers." (Research)

"Developing Computer-Aided Instruction Software for Chemistry." (Research)

"Development of Molecular Graphics Software." (Research)

"Personalized System of Instruction in Physical Chemistry."

12. STRAWSER, Larry D., Captain and Associate Professor

a. "An Overview of the New Biotechnology." Air Force Materials Laboratory, Wright-Patterson AFB, Dayton, OH, 15 July 1986. (Presentation)

I gave an overview of biotechnology to the scientists and engineers working at the AF Materials Labortory.

b. "Biotechnology Applications to Materials Science." Air Force Materials Laboratory, Wright-Patterson AFB, Dayton, OH, 29 July 1986. (Presentation)

I presented some potential biotechnology applications in materials science to the scientists and engineers working at the AF Materials Laboratory. The topics presented included lubricants, composites, adhesives, electronic devices, production of polymers and metal purification.

c. With Dr. J.J.P. Stewart (Frank J. Seiler Research Laboratory/AFOSR) and Major D.M. Storch. "Computational Studies of Enzyme Catalysis." First Gordon Research Conference on Computational Chemistry, New London, NH, 4-8 August 1986. (Presentation)

We presented our results of quantum chemical calculations of the active site of the enzyme alpha-chymotrypsin. Our results demonstrated that current views of the catalytic activity of alpha-chymotrypsin are not totally correct.

d. With Captain J.C. Noetzel and Major D.M. Storch. "Computer-Aided Instruction in the Department of Chemistry at the U.S. Air Force Academy." American Chemical Society Meeting, Denver, CO, 8-12 June 1986. (Presentation)

I presented an overview of the computer-aided instructional system the Department of Chemistry has developed over the last five years.

e. With Captains J. C. Noetzel and G.W. Tessmer. "Computer-Managed Instruction in the Department of Chemistry at the U.S. Air Force Academy." Eighth Rocky Mountain Regional Meeting, American Chemical Society, Denver, CO, 10 June 1986. (Presentation)

See E8b

f. With Dr. J.J.P. Stewart (Frank J. Seiler Research Laboratory/AFOSR) and Major D.M. Storch. "Mechanism of Alpha-Chymotrypsin Catalysis Using Semi-Empirical Methods." Cray Research, Inc., Mendota Heights, MN, 26 July 1986. (Presentation)

See E11d

g. With J.J.P. Stewart (Frank J. Seiler Research Laboratory/AFOSR) and Major D.M. Storch. "Mechanism of Alpha-Chymotrypsin Catalysis Using Semi-Empirical Methods." *Proceedings of the First Symposium on Computational Chemistry on Cray Supercomputers*, Cray Research, Inc., Mendota Heights, MN. (Forthcoming Article)

See E11e

h. With Major L.P. Davis (Air Force Office of Scientific Research) and Major D.M. Storch. "Physical Chemistry at USAFA: Personalized Instruction." (Forthcoming Article)

See E11g

i. "Specific Examples of Recombinant DNA Technology." Air Force Materials Laboratory, Wright-Patterson AFB, Dayton, OH, 22 July 1986. (Presentation)

I presented some specific examples of the use of biotechnology to solve current problems of biochemistry and molecular biology to the scientists and engineers at the AF Materials Laboratory.

j. "The New Biotechnology." Harrison High School, Colorado Springs, CO, 20 May 1986. (Presentation)

I was a guest speaker for the advanced placement biology class for junior and senior students. Several faculty members also attended.

k. With Dr. J.J.P. Stewart (Frank J. Seiler Research Laboratory/AFOSR) and Major D.M Storch. "Theoretical Studies of the Active Site of Alpha-chymotrypsin." 26th Sanibel Symposium, Marineland, FL, 6-15 March 1986. (Presentation)

We presented current results of our theoretical study of the catalysis of biological reactions by enzymes.

l. "Use of Computers in Chemical Education Symposium."American Chemical Society Meeting, Denver, CO, 8-12 June 1986. (Conference)

I was the organizer and Chairman of the above symposium, in which educators from colleges throughout the country presented their work. In addition to these presentations, there was a panel discussion entitled "Can Computers Really Help Us Teach Chemistry?" as well as an afternoon session featuring a "hands-on" demonstration of software.

13. SUMMER, Peter D., III., Captain and Assistant Professor

a. With Majors W.B. Avila and M.D. Braydich, M.E. Key (St Albans High School), J. Lieberman (T.C. Williams Sr. High Schoo.), and Lt Colonel J.R. Wright. "XVII International Chemistry Olympiad Study Camp." USAFA, Colorado Springs, CO, June 1986. (Conference)

See E1a

b. With Major W.B. Avila, M.D. Hampton (University of Central Florida), M.E. Key (St Albans High School), and Lt Colonel J.R. Wright. "U.S. Chemistry Olympiad Program: Participation and Current Development." Eighth American Chemical Society Rocky Mountain Regional Meeting, Denver, CO, 10 June 1986. (Presentation)

We presented information about training of the U.S. team for competition in the International Chemistry Olympiad.

c. With Major W.B. Avila, M.E. Key (St Albans high School), and Lt Colonel J.R. Wright. "U.S. Chemistry Olympiad Program: Participation and Current Development." 192nd National American Chemistry Society Meeting, Anaheim, CA, 7-12 September 1986. (Presentation)

See E1g

14. TESSMER, George W., Major and Assistant Professor

a. With Captains J.C. Noetzel and L.D. Strawser. "Computer-Managed Instruction in the Department of Chemistry at the U.S. Air Force Academy." Eighth Rocky Mountain Regional Meeting, American Chemical Society, Denver, CO, 10 June 1986. (Presentation)

See E8b

15. UTERMOEHLEN, Clifford M., Major and Assistant Professor

a. "Synthesis of Potential Metabolites in the 1,2,3,4 and 5,6,7,8 Benzo Ring Positions of the Polycyclic Aromatic Hydrocarbon Benzo (g) Chrysene." University of Oklahoma, Norman, OK, May 1986. (Dissertation)

Polycyclic aromatic hydrocarbons are unavoidable pollutants of our environment. Cancers have been linked directly to these contaminants. Recent work supports the finding that an "ultimate carcinogen" in the metabolic path is a bay region diol epoxide derivative. I describe the total syntheses of even more hindered diol epoxides of the fijord region of benzo (g) chrysene. In all, I include the syntheses of two diol epoxides, one tetrahydroepoxide and two dihydrodihydroxy derivatives as potential metabolites of the parent molecule. Synthetic material is now available for structure activity studies and for comparisons with isolated material from mutagenicity and tumorigenicity studies.

16. WRIGHT, James R., Lt Colonel and Tenure Associate Professor

a. With Majors W.B. Avila and M.D. Braydich, M.E. Key (St Albans High School), J. Lieberman (T.C. Williams Sr. High School), and Captain P.D. Summer, III. "XVII International Chemistry Olympiad Study Camp." USAFA, Colorado Springs, Co, June 1986. (Conference)

See E1a

b. With Major W.B. Avila, M.D. Hampton (University of Central Florida), M.E. Key (St Albans High School), and Captain P.D. Summer, III. "U.S. Chemistry Olympiad Program: Participation and Current Development." Eighth American Chemical Society Rocky Mountain Regional Meeting, Denver, CO, 10 June 1986. (Presentation)

See E13b

c. With Major W.B. Avila, M.E. Key (St Albans High School), and Captain P.D. Summer, III. "U.S. Chemistry Olympiad Program: Participation and Current Development." 192nd National American Chemistry Society Meeting, Anaheim, CA, 7-12 September 1986. (Presentation)

See E1g

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CHAPTER F

DEPARTMENT OF CIVIL ENGINEERING

The mission of the Department of Civil Engineering is to provide cadets an accredited civil engineering program so they graduate with the knowledge necessary to be successful engineers and the character and motivation to be career officers in the Air Force. Research within the department provides three benefits: ways for instructors to maintain proficiency within their specialties, help in solving Air Force engineering problems, and opportunities for cadets to participate in Air Force research and programs.

1. KRAMER, David F., Cadet

a. Under the supervision of Captain Joe Smith and Captain William Kitch (AFWL/NTE). "An Evaluation of Program 'EXPERT'." June 1986. (Presentation)

I performed a technical evaluation of a three-dimensional interpolation program for the Air Force Weapons Laboratory. This program is called "EXPERT" and is capable of performing both linear and non-linear interpolation and extrapolation of data in three-dimensional space. I used actual field test data from a combined air blast and directly induced nuclear weapons simulation test. The program evaluation included a parameter study and a comparison of extrapolation versus interpolation.

2. REYNOLDS, Michael F., Captain and Assistant Professor

a. "Features to Look for in Educational Software." Third Nationl Conference on Microcomputers in Civil Engineering, Orlando, FL, November 1985. (Paper and Presentation)

I discuss the special programming features that we put in the software we author. These same features should be included in educational software.

3. RIGGS, Gregory E., Major and Associate Professor

a. "Using Computers to Improve Civil Engineering Education." Third National Conference on Microcomputers in Civil Engineering, Orlando, FL, November 1985. (Paper and Presentation)

b. "Using Microcomputers as a Classroom Teaching Tool." Third National Conference on Microcomputers in Civil Engineering, Orlando, FL, November 1985. (Paper and Presentation)

c. "Improvements for the Future in Civil Engineering Education." American Society for Civil Engineers, Educational Division, Spring Conference, Seattle, WA, April 1986. (Presentation)

d. "The Role of Computers in Design." American Society for Engineering Education National Conference, Cincinnati, OH, June 1986. (Paper and Presentation)

This series of papers discusses the effective use of computers to improve undergraduate civil engineering education. It addresses such issues as proper educational applications of computers, considerations for hardware selection and software selection/development, funding sources, and integration into existing curricula. Specific examples from Air Force Academy experience illustrate many of the concepts presented.

4. SMITH, Joseph L., Captain and Instructor

a. Revision to "Air Force Manual for Design and Analysis of Hardened Structures." (Review and Consultation)

I performed a technical evaluation of contractual revisions to the above work. This review concentrated on ground shock and cratering from nuclear weapons. Several significant technical errors were noted and brought to the attention of the project officer and contractor.

5. WACHINSKI, Anthony M., Major and Associate Professor

a. "Potential Roles for Air Force Engineering and Services in Future Aerospace Operations." Air Command and Staff College, Air University, Maxwell AFB, AL, June 1986. (Thesis)

I addressed the role of Air Force Engineering and Services in the future with emphasis on aerospace activities in the twenty-first century. I also made recommendations on how Engineering and Services should prepare for these new roles.

CHAPTER G

DEPARTMENT OF COMPUTER SCIENCE

The mission of the Computer Science Department, in support of the mission of the U.S. Air Force Academy, is to graduate second lieutenants who are prepared to take their place in an Air Force which is becoming increasingly dependent on computer technology.

1. COOK, David A., First Lieutenant and Instructor

a. With First Lieutenant Bethana C. Ross (Keesler Air Force Base). "Ada for the COBOL Programmer." Proceedings of the Annual Washington Ada Symposium, March 1986. (Paper and Presentation)

We cover problems encountered when teaching Ada to heavily COBOL-oriented programmers, and explore several possible solutions to help COBOL programmers transition to Ada.

2. HELSABECK, Michael L., Captain and Instructor

a. With Mladen A. Vouk, Kuo-Chung Tai and David F. McAllister (all of North Carolina State University). "On Testing of Functionally Equivalent Components of Fault Tolerant Software." Computer Software and Applications Conference, Chicago, IL, 8-10 October 1986. (Paper)

We tested several programs regarding fault tolerant software applications. We also determined the effectiveness of random testing and special value testing.

3. JENKINS, Joyce R., Captain and Instructor

a. "Automated Generation of Input/Output Pairs for the CAIS Validation Test Suite." Arizona State University, Tempe, AZ, May 1986. (Thesis)

I addressed automating the process of generating test cases for use in constructing a validation test for the common APSE interface set (CAIS), a tool in the Ada environment.

b. With Dr. Timothy E. Lindquist (Arizona State University). "Test Case Generation with IOGEN." (Forthcoming Paper and Presentation)

We discuss the use of IOGEN, a statis analysis tool for Ada Code, for generating a validation suite and testing Ada software.

4. KRAUSE, Kenneth L., Lt Colonel and Tenure Professor

a. "The Delivery of Education Using Current Technology." 1985 Association for Computer Machinery Annual Conference, Denver, CO, 14-16 October 1985. (Conference)

I chaired the panel session at the national conference.

5. MALLARY, Thomas C., Captain and Instructor

a. "Design of the Human-Computer Interface for a Computer-Aided Design Tool for the Normalization of Relations." School of Engineering, Air Force Institute of Technology (AU), Wright-Patterson AFB, OH, December 1985. (Thesis)

The project involved the design and implementation of the human-computer interface of a computer-aided design tool used in conjunction with a relational database. The tool gives a database administrator an interactive means of specifying functional dependencies for a given relation. I also developed a tool to measure and quantify the extent of user satisfaction in the software system.

6. McKENNEY, David G., Captain and Instructor

a. With Captains Robert Steigerwald and Silvi K. Steigerwald (DFEE). "Current Trends in Artificial Intelligence." Southern Colorado Chapter of Data Processing Management Association Seminar, Colorado Springs, CO, 7 April 1986. (Presentation)

See 113b

b. Work in Progress

"Trend Analysis Report for Air Force Space Command." (Research)

7. MONROE, Joseph, Colonel, Permanent Professor and Head

a. "A Recommended Curriculum for Undergraduate Computer Science." North Carolina Conference on Undergraduate Computer Science, Raleigh, NC, 5-9 September 1986. (Presentation)

I described our computer science program and explained how it met the Computing Sciences Accreditation Board (CSAB) criteria for accrediting programs in computer science in the United States.

b. "Computer Science in the Secondary School." Southeastern North Carolina Educators, Lumberton, NC, 7 July 1986. (Presentation)

I outlined the contents of a proposed college preparatory course in computer science. I strongly recommended that it should emphasize problem solving as well as programming methodology.

8. NILSON, Jimmy D., Major and Associate Professor

a. Work in Progress

"Investigation of Fourth Generation Languages in a Computer Science Curriculum." (Research)

9. RICHARDSON, William E., Major and Associate Professor

a. "The Delivery of Education Using Current Technology." 1985 Association for Computer Machinery Annual Conference, Denver, CO, 14-16 October 1985. (Conference)

I coordinated the panel session moderated by Lt Colonel Kenneth L. Krause.

b. "Why is Software Engineering So Difficult?" Software Engineering Education Workshop, Software Engineering Institute, Pittsburgh, PA, 27-28 February 1986. (Paper)

I discuss four major categories of problems which are inherent in the discipline called software engineering. I attempt to give a rational explanation for these problems.

10. SCHWEITZER, Dennis L., Major and Associate Professor

a. Work in Progress

"A Test-bed Environment for High-Quality Computer-Generated Imagery." (Research)

11. STEIGERWALD, Robert A., Captain and Instructor

a. "Reusable Software Components." University of Illinois, Urbana, IL, December 1985. (Thesis)

I addressed the topic of reusable software components, component libraries and languages for building components. The major focus is on how to collect components into libraries and on languages designed to facilitate creating reusable components (including Ada).

b. With Captains Silvi K. Stigerwald (DFEE) and David G. McKenney. "Current Trends in Artificial Intelligence." Southern Colorado Chapter of Data Processing Management Association, Colorado Springs, CO, 7 April 1986. (Presentation)

See 113b

12. TOMLINSON, Robert L., Jr., Captain and Assistant Professor

a. Work in Progress

"An Approach to Detecting Common Series of Code in PASCAL Programs, where the Number of Program Comparisons is Linearly Proportional to the Number of Programs." (Research)

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CHAPTER H

DEPARTMENT OF ECONOMICS AND GEOGRAPHY

Our research objective in the Department of Economics and Geography is to integrate cadet learning with current Air Force problems. This research enables each faculty member to apply his or her unique experiences in assisting Air Force commands and agencies. In the area of Economics, we provide cadets with the capability and opportunity to perform economic analysis, especially analysis of resource allocation problems associated with national security. Research undertaken by the department addresses current problems and techniques of economic analysis, for integration into courses and improved effectiveness of Air Force resource allocation.

We also encourage cadet involvement in applying research knowledge to current Geography topics. For example, our faculty is involved with research on the impact that military retirees have on a region's economy, automated spatial analysis using remotely sensed data, microcomputer-based cartography, and display of perspective map data in three-dimensional format for in-cockpit systems.

1. BARNES, C. Taylor, Lt Colonel, Tenure Associate Professor and Head of Geography

a. "Balikesir, Turkey: Your Home Away From Home." 188th Tactical Fighter Group, Fort Smith, AR, 12-13 July 1986. (Presentation)

I presented the geography and culture of the Balikesir region to 250 National Guardsmen deploying to Turkey.

b. "The Geography of Turkey: A Case Study." 122nd Tactical Fighter Wing, Fort Wayne, IN, 9-10 August 1986. (Presentation)

I presented a briefing on the physical and human geography of Turkey to 275 National Guardsmen prior to their deployment to Turkey.

c. "The Impact of Military Retirement Migration on Population Redistribution in the Southwest." Southwest Association of American Geographers Annual Meeting, San Marcos, TX, 25-27 September 1986. (Presentation)

Military retirees have considerable impact on the areas in which they choose to live. Using a logit probability model, I found a high positive relationship between the selection of a retirement location and military experience.

d. "The Physical and Cultural Geography of Spain." 163rd Tactical Fighter Group, March AFB, CA, 4-6 April 1986. (Presentation)

I surveyed the physical and cultural environment of Spain and emphasized how ethnocentric behavior can negatively impact on mission accomplishment.

e. "The World Regional Geography Project." Association of American Geographers, Minneapolis, MN, 4-7 May 1986. (Presentation)

I presented the results of the Rocky Mountain-Great Plains Geography Curriculum Project to the National Steering Committee. Our committee developed a college-level curriculum that emphasized a systematic approach to regional geography.

2. BROCK, John R., Jr., Major and Associate Professor

a. Work in Progress

"The Impact of Federal Subsidies for Research and Development on Firm Behavior." (Dissertation)

3. FLEMING, Kenneth H., Colonel, Permanent Professor, and Vice Dean

a. With Captain David C. Nielsen. "An Analysis of Replacement Costs of Trained Enlisted Personnel." Office of the Director, Maintenance and Supply, HQ USAF, Denver Conference, Denver, CO, 17 June 1986. (Presentation and Forthcoming Article)

See H7a

b. With Captain David R. LaRivee. "Military Impact on the Colorado Springs Economy." Missouri Valley Economic Association, St. Louis, MO, 7 March 1986. (Presentation)

We are constructing a model of the Colorado Springs economy using historical and survey data. We estimate income and employment multipliers in the key economic sectors. Our ultimate goal is to forecast where and how military growth in the region will affect the regional economy.

c. Work in Progess

"Cost Effectiveness Measures of Government Acquisition Programs." (Article)

4. KOOL, Leslie H., Lt Colonel and Assistant Professor

a. Work in Progress

"Economic Development in Galicia: 1857-1910." (Dissertation)

5. LARIVEE, David R., Captain and Instructor

a. With Colonel Kenneth H. Fleming. "Military Impact on the Colorado Springs Economy." Missouri Valley Economic Association, St. Louis, MO, 7 March 1986. (Presentation)

See H3b

6. NELSON, Douglas, Major and Assistant Professor

a. With Eugene Silberberg (University of Washington). "Ideology and Legislative Shirking." (Forthcoming Article)

We study the concept of legislative shirking--the theory that legislators vote according to personal ideology rather than the dictates of their constituency. We determined that shirking is a real issue in Congress, but when it occurs, it adheres to the law of demand--the higher the cost (reelection probability), the less the inclination to practice shirking. Our results confirmed the theory with an additional conclusion that Congress tended to practice shirking on general expenditure bills vs. specific appropriations.

7. NIELSEN, David C., Captain and Instructor

a. With Colonel Kenneth H. Fleming. "An Analysis of Replacement Costs of Trained Enlisted Personnel." Office of the Director, Maintenance and Supply, HQ USAF, Denver Conference, Denver, Co, 17 June 1986. (Presentation and Forthcoming Article)

We constructed a methodology and model to estimate the full replacement cost of trained Air Force enlisted personnel.

b. Work in Progress

"T-41 Flying Requirements for Rated Faculty." (Consultation)

8. PAPIRTIS, Michael F., Captain and Assistant Professor

a. "Micro-based Computer Cartography--Phase II." Sponsored by the Defense Mapping Agency, 15 September 1986. (Consultation)

I identified the requirements for upgrading hardware and software to support microcomputer-based cartography, acquired the necessary components, and set up a functioning laboratory for instruction and experimentation in handling digital cartographic databases. The upgade was based on the Air Force Z-248 standard microcomputer.

b. Work in Progress

"Multi-temporal, Multi-sensor Classification of Imagery: LANDSAT, SPOT, and SAR Systems." (Presentation)

9. RANEY, Terry L., Major and Assistant Professor

a. "Acquisition in Defense Economics." Conference on Acquisition in Defense Economics, USAFA, Colorado Springs, CO, 24-26 March 1986. (Conference)

I was the Department Coordinator for the above conference, which the Department of Economics co-sponsored with the Office of the Secretary of Defense, Program Analysis and Evaluation (OSD PA&E) on the economics of defense acquisition. The purpose was to bring together academic economists interested in doing research in the methodology of defense acquisition and DoD leaders in the acquisition field. Presentations were made on various aspects of the organization of defense systems acquisition by eight noted acquisition professionals.

b. Work in Progress

"The Effects of Department of Defense Financing and Profit Policies on Capital Investment and Profitability in the Defense Industrial Sector from 1970 to 1984." (Dissertation)

10. ROTH, Russell T., Major and Assistant Professor

a. "Environmental Concerns in United States Air Forces in Europe." (Report)

I worked as part of a multi-disciplinary team of faculty members from the Academy analyzing the environmental problems facing all U.S. Forces in Europe. I made policy recommendations in a written report to the Environmental Coordinator for USAFE to institute policies to meet host nation environmental standards.

b. "Quantifying Experience in the Value of Human Capital." Western Economic Association, Reno, NV, 24 April 1986. (Presentation)

I developed a model to quantify the value of the experience lost when an officer leaves the Air Force. Based upon the assumption that the Air Force gets as much "production" from an individual as it costs to pay and train him, a quantitative model was developed. The value of the individual in the future could then be determined.

c. Work in Progress

"A Comparison of Military and Civilian Pilot Jobs." (Report and Consultation)

"Cost Estimating Methodologies for the Strategic Defense Initiative." (Report and Consultation)

11. SALVATI, James R., First Lieutenant and Instructor

a. "Computer Models for Evaluating Alternative Mobilization Actions." National Defense University, July 1986.

In a study chartered by the Mobilization Concepts Development Center, I researched alternative computer models that are designed to assess the impact of various mobilization actions.

12. WALLER, Robert L., Major and Associate Professor

a. "Software Cost Estimation Survey." Electronic Systems Division (ESD), Hanscom AFB, MA, 11 June-9 July 1986. (Consultation)

Many cost and scheduling difficulties have been encountered in software development efforts related to modern defense systems. At the request of the ESD Computer Systems Engineering Office, I surveyed the available literature and conducted interviews to learn of currently available techniques and of evolving methods of software cost estimation that would be of benefit to Air Force Systems development.

CHAPTER I

DEPARTMENT OF ELECTRICAL ENGINEERING

The primary goal of our research program is to enhance the Electrical Engineering education process in three areas: faculty enrichment, cadet research experience, and curriculum development. Faculty members broaden their technical expertise while contributing to the solution of significant Air Force problems. Cadets receive highly motivational technical experience by participating in our sponsored research projects. Finally, new and existing courses and laboratories incorporate techniques and results from our research. Our research program maintains the technical currency of our officers, students and curriculum in order to support the Academy's mission and long-range Air Force objectives.

1. ALI, Azar S., Captian and Instructor

a. "Time-Domain Reflectometry Using Scattering Parameters and a De-Imbedding Application." University of Illinois Urbana, IL, May 1986. (Thesis)

I develop a Time-Domain Reflectrometer (TDR) by using measured values of scattering parameters. This TDR is then used to examine the response of various devices to arbitrary input signals. The response is then processed to remove (de-imbed) any unwanted distortion.

2. ARPIN, David A., Major and Instructor

a. "A Parallel Processor for the Solution of Large Sparse, Symmetric Linear Systems." University of Washington, Seattle, WA, May 1986. (Dissertation)

I describe the design of a parallel computer architecture for the solution of large, sparse systems of linear equations. I also describe a detailed simulation which was used to assess the performance of the architecture, a prototype of the processing node, and the results of simulation and prototype testing. I compare these rsults with those of other approaches to this type of problem.

b. With Dr. Yongmin Kim (University of Washington). "A Parllel Architecture for the Solution of Large, Sparse, SPD Linear Systems." *Software and Hardware Applications of Microcomputers - MIMI '86*, Proceedings of the International Symposium of the International Society for Mini and Microcomputers, February 1986, pages 83-87. (Paper and Presentation)

In this paper, we describe the basic architecture I designed in item 12a. I presented this paper at the above conference.

c. With Dr. Yongmin Kim (University of Washington). "PARSOR: A Parallel Processor for Sparse Matrix Solution by SOR Iteration." Proceedings of the 1986 International Conference on Parallel Processing, August 1986, pages 684-687. (Paper and Presentation)

In this paper, we briefly presented the design of the system described in item 12a, and then presented the results of the simulation and prototype testing. I presented this paper at the above conference in August 1986.

3. GUYOTE, Michael F., Lt Colonel and Associate Professor

a. With Dr. P.E. Mast, Distinguished Visiting Professor (University of Illinois). "Optical Fiber Communications Short Course." 1957th Radar Evaluation Squadron, Hill AFB, UT, 10-17 March 1986. (Presentation)

We presented the theory and operation of state of the art optical fiber communications systems to the engineers and staff at Hill AFB.

b. With Major K.A. Lewis, donald Lijana (UCCS Student Assistant). "A Speech Data Base at the U.S. Air Force Academy." International Conference on Acoustics, Speech, and Signal Processing, Tokyo, 4-7 April 1986. (Paper and Presentation)

We discussed work on a computer-run data collection system, which collects four channels of speech data for use by machine-based speech recognition systems.

c. Work in Progress

"Collection of Speech Data Base." (Research)

"Machine Based Speech Recognition." (Research)

4. LEWIS, Keith A., Major and Assistant Professor

a. With Lt Colonel M.F. Guyote and Donald Lijana (UCCS Student Assistant). "A Speech Data Base at the U.S. Air Force Academy." International Conference on Acoustics, Speech, and Signal Processing, Tokyo, 4-7 April 1986. (Paper and Presentation)

See 13b

5. MARK, Martin B., Captain and Instructor

a. "Multipixel Multidimensional Laser Radar System Performance." Masschusetts Institute of Technology, Cambridge, MA, June 1986. (Dissertation)

Laser radars have sufficient spatial resolution to produce images of targets. This work rigorously derives processors (and their performance measures) which take advantage of the spatially distributed information in the image for range, velocity, and intensity measurements. Previously, researchers concentrated on adhoc processors whose performances were difficult to predict.

6. MARTIN, Daniel L., Captain and Assistant Professor

a. With Majors David R. Robertson and Michael F. O'Shea. "Data Communications short Course." Hill AFB, UT, March 1986; Hickam and Wheeler AFB, HI, July 1986. (Presentation)

We presented principles of data communications techniques to engineers and staff.

b. "Interactive Communications Simulator." (Research)

I installed a Floating Point Systems 5205 array processor on DFEE's Harris H800 minicomputer.

c. With C1Cs Velazquez and Zimmerman. "UHF Satellite Antenna." May 1986. (Project)

We designed, built and tested a tactical UHF ground station satellite antenna for AF Communications Command.

d. Work in Progress

Data Communications Handbook. (Book)

7. MONAGHAN, Glen E., Captain and Instructor

a. Work in Progress

"Utilitarian Service Automaton for Aircraft: An Aircraft-Refueling Robot." (Consultation)

"World Models and Navigation Techniques for Mobile Robots." (Article)

8. MOODY, Theodore J., Captain and Assistant Professor

a. "Electronic Voice and Communicator for Cerebral Palsy Patient." 16 May 1986. (Project)

This project provided for an eleven-year-old girl a way to communicate. The equipment consists of a computer, voice systhesizer, printer, keyboard and display. When a key on the keyboard is pressed, a phrase or word stored in memory is sent to either the voice synthesizer or the printer.

b. "Heat Sinks." Department of Electrical Engineering, September 1986. (Paper)

I describe the design and/or choice of heat sinks for power transistors based on the power they must dissipate. The paper was used to supplement course material on the subject since the topic was not covered in the course text.

c. With Stone and Webster Corporation of Denver, CO. "Instrumentation and Control System Application." Department of Electrical Engineering, 8 May 1986. (Film)

This is a thirty-five minute video tape presentation of Instrumentation and Control systems, as applied to the design and construction of power plants.

d. With Dr., Edward P. Mast, Distinguished Visiting Professor (University of Illinois) and Major Robert F. Phelps. "A Sequential, Integrated Laboratory Program: The First Year and a Half." 1986 ASEE Rocky Mountain Section Meeting, Laramie, WY, 18-19 April 1986. (Presentation)

We described the work done at the Air Force Academy to integrate the three required lab courses into a meaningful sequence.

e. "SPICE Made Simple." 1986 ASEE Rocky Mountain Section Meeting, Laramie, WY, 18-19 April 1986. (Presentation)

I introduced the program BSPICE, a file editor to be used with the circuit simulation program SPICE. BSPICE creates the input file for SPICE, saving the user from having to learn the input syntax required for SPICE.

f. "The Universal Filter." Department of Electrical Engineering, September 1986. (Paper)

I describe the use of the same basic active quadratic filter for low pass, high pass or band pass operation. The paper was used to supplement course material on the subject since the topic was not covered in the course text.

g. Work in Progress

"Computer-Aided Design Program for Active Electronic Filters." (Research)

"Computer-Aided Design Program for Drawing Graphics Presentation from a SPICE Output File." (Research)

"Computer-Aided Design Programs for Use in the Electrical Engineering Department." (Research)

"Conversion of SPICE from the VAX computer to the Harris computer." (Research)

"File editor on the Z-248 for SPICE." (Research)

9. PECOR, Bruce R., Captain and Assistant Professor

a. With Captain Fernando Rojas. "Optial Fiber Communications Short Course." Hickam AFB, HI, July 1986. (Presentation)

We presented the underlying theory of operation of light sources, optical fibers and light detectors to engineers and technicians.

10. ROBERTSON, David R., Major and Assistant Professor

a. With Major Michael F. O'Shea and Captain Daniel L. Martin. "Data Communications Short Course." Hickam AFB, HI, July 1986. (Presentation)

See 16a

11. ROJAS, Fernando P., Captain and Instructor

a. With Captain Bruce Pecor. "Optical Fiber Communications Short Course." Hickam AFB, HI, July 1986. (Presentation)

See 19a

12. SODA, Kenneth J., Major and Assistant Professor

a. Work in Progress

"Cooperative Solid State Research." (Research)

13. STEIGERWALD, Silvi K., Captain and Instructor

a. "Development Tools for a Speech Mimicking System." University of Illinois, Champaign, IL, December 1985. (Thesis)

I developed several software programs to extract spech parameters that were common among many speakers.

b. With Captain David McKenney (DFCS) and Captain Robert Steigerwald (DFCS). "Introduction to Artificial Intelligence." Data Processing Management Association, 7 April 1986. (Presentation)

We gave an introduction to artificial intelligence and I presented the topics involving speech processing, vision and robotics.

CHAPTER J

DEPARTMENT OF ENGINEERING MECHANICS

The Department of Engineering Mechanics supports the mission of the USAF Academy by providing the cadets with a strong background in mechanics and materials and the motivation to become career officers in the United States Air Force. Our department research goal is to help maintain technical currency for our faculty members and to provide professional development opportunities for both faculty members and cadets. In addition to consultation and course development, our primary research focuses on advanced composite material, large space structures, space experimentation, fatigue crack growth in aerospace materials, and the response of protective structures to explosive blast and shock effects.

1. BECKER, Marvin L., Major and Assistant Professor

a. With Major M.S. Ewing and Captain D.J. Nicholls. "Strength, Toughness and Structural Damping Characteristics of Tough, Rubber-Modified Epoxy Interlayers in High-Stiffness Composites." Work sponsored by Frank J. Seiler Research Laboratory. (Research)

See J9b

2. DUKE, John P., Captain and Instructor

a. Work in Progress

"Validation of Analysis and Control of Large Space Structures." (Research)

"Design of Finite Dimensional Optimum Controllers for Infinite Dimensional Plants with Application to Large Space Structures." (Research)

3. EWING, Mark S., Major and Tenure Associate Professor

a. With Captain Robert J. Hinger and Professor Arthur W. Leissa (Ohio State University). "Accuracy of the Reduced Bending Stiffness Representation of Laminated Composite Plates." (Research)

The reduced bending stiffness (RBS) of panel laminated composite plates or panels (such as graphite epoxy aircraft skin) is a simplified model which is much less complicated than exact theories. We determined the accuracy of the RBS theory for bending, vibration and buckling by comparing it with exact theory for various types and shapes of panels.

b. With Captain Robert J. Hinger and Professor Arthur W. Leissa (Ohio State University). "Comparison of the Reduced Bending Stiffness Method with Exact Theories of Bending, Buckling and Vibration of Antisymmetric Laminated Plates." (Research)

We discussed the accuracy of the RBS theory (see item a) for laminated composite plates as compared with many published references. We noted several errors in the works and presented the appropriate corrections.

c. With Colonel Cary A. Fisher and Second Lieutenant Terry N. Armstrong (research assistant). "Design of Lightweight Aircraft Structures with a Microcomputer Toolkit." *Proceedings, 1986 American Society for Engineering Education Annual Conference*, pp 201-204, Cincinnati, OH, June 1986. (Article and Presentation)

We described how we have used microcomputer software to help our students learn a design process. The software helps them do time-consuming, repetitive calculations which allow them the time to concentrate on design tradeoffs rather than their arithmetic skills.

Dorman Schmidt sets up a cable transducer for Major Marksteiner's and Captain Nicholls' C-130 consulting project.

d. "Evaluation of the RAD Flexural Rigidity Sensor (FRS)--Interim Report on Work through 15 August 1986." Sponsored by the Defense Advanced Research Project Agency (DARPA) X-29 Project Office. (Report)

I compared the frequency response and sensitivity characteristics of a new, novel sensor with state-of-the-art sensors. This sensor is being considered for use in flight tests.

e. With Major Marvin Becker and Captain David Nicholls. "Strength, Toughness and Structural Damping Characteristics of Tough, Rubber-Modified Epoxy Interlayers in High-Stiffness Composites." Work sponsored by Frank J. Seiler Research Laboratory. (Research)

See J9b

f. "Using the Apple IIe Microcomputer and the Adalab Interface Card for Transducer Measurement and Process Control." *Proceedings, 1986 American Society for Engineering Education Annual Conference*, pp 1163-1167, Cincinnati, OH, June 1986. (Article and Presentation)

I described how we have used the Apple computer with the Adalab card in our teaching and research activities. The Adalab card allows the computer to control various external devices (such as heaters and motors) based on signals from measurement devices (such as thermocouples).

g. With Colonel Cary A. Fisher and Professor Arthur W. Leissa (Ohio State University). "Vibrations of Antisymmetrically Laminated Composite Plates Subjected to Normal Inplane Initial Stress." *Proceedings, Fourth International Conference on Composite Structures*, Paisley College of Technology, Paisley, Scotland, 27-29 July 1986. (Research)

See J4f

h. With Colonel Cary A. Fisher. "A Zero-Based Mechanics Curriculum." *Proceedings, 1986 American Society for Engineering Education Annual Conference*, pp 1627-1630, Cincinnati, OH, June 1986. (Article and Presentation)

We described our efforts to design a new mechanics curriculum based on "what a mechanics curriculum should be" rather than "how we've always done it" and "how they've always done it."

i. Work in Progress

"Accurcy of the Reducd Bending Stiffness Representation of Laminated Composite Plates." (Paper)

"Comparison of the Reduced Bending Stiffness Method with Exact Theories of Bending, Buckling and Vibration of Antisymmetric Laminated Plates." (Paper)

4. FISHER, Cary A., Colonel, Permanent Professor and Department Head

a. "Computers for All--Opportunity or Headache?" 1985 American Society for Engineering Education Pacific Southwest Section Conference, San Diego, CA, November 1985. (Presentation)

I outlined the Academy's ambitious local area network program. I then describe how one engineering department is approaching the use of computers in undergraduate engineering education.

b. With Lia Brillhart (Triton College) and Lt Colonel James G.R. Hansen (EOARD, London). "Curricular Emphasis in Mechanics: A National Update." *Engineering Education*, pp 664-669, American Society for Engineering Education, Washington D.C., April 1986 (Article)

We present recent findings of a national survey on mechanics courses taught at the undergraduate level.

c. With Major Mark S. Ewing and Second Lieutenant Terry N. Armstrong (research assistant). "Design of Lightweight Aircraft Structures with a Microcomputer Toolkit." *Proceedings, 1986 American Society for Engineering Education Annual Conference*, pp 201-204, Cincinnati, OH, June 1986. (Article and Presentation)

See J3c

d. With Lia Brillhart (Triton College) and Lt Colonel James G.R. Hansen (EOARD, London). "Instructional Techniques Used in U.S. Mechanics Education." *International Journal of Engineering Education*. (Forthcoming Article)

We summarized and specialized the data obtained from the national survey on mechanics undergraduate engineering education (see item b).

e. "A Survey of Mechanics Education in the Chemical Engineering Curriculum." American Institute of Chemical Engineers. (Forthcoming Article)

We summarized and specialized the data obtained from the national survey on mechanics undergraduate engineering education (see items b and d).

f. With Major Mark S. Ewing and Professor Arthur W. Leissa (Ohio State University). "Vibrations of Antisymmetrically Laminated Composite Plates Subjected to Normal In-Plane Initial Stresses." *Proceedings, Fourth International Conference on Composite Structures*, Paisley College of Technology, Paisley, Scotland, 27-29 July 1986. (Research)

Antisymmetrically laminated composite plates are a special class being considered for advanced aircraft skin. We studied the effect of in-plane loading on the natural vibration frequencies of these plates or panels.

g. With Major Mark S. Ewing. "A Zero-Based Mechanics Curriculum." *Proceedings, 1986 American Society for Engineering Education Annual Conference*, pp 1627-1630, Cincinnati, OH, June 1986. (Article and Presentation)

See J3h

h. Work in Progress

"Vibrations of Antisymmetrically Laminated Compostie Plates Subjected to Normal In-Plane Initial Stresses." (Paper)

5. GALBRAITH, Jay M., Captain and Instructor

a. With P.R. Howell and M.H. Tosten (both of Pennsylvania State University). "On the Equilibrium Shape of Nuclei at Interphase Interfaces." *Journal of Material Science Letters*, Chapman and Hall, Ltd., p 881, September 1986. (Article)

We used the auxiliary gama-plot to determine the shape of a third phase at a planar interphase interface and to determine the energy barrier to nucleation. We showed that this approach greatly facilitates the derivation of the energy barrier to nucleation.

b. "A Microstructural Characterization of an Aluminum-Copper-Lithium-Zirconium Alloy." Department of Materials Science and Engineering, Pennsylvania State University, State College, PA, March 1986. (Thesis)

I documented the microstructural development of an Al - 1.0%Li - 4.5%Cu - 0.12%Zr alloy, principally by transmission electron microscopy as well as by some X-ray microanalysis. The alloy material was aged at 190 C for times in the range of thirty minutes to 128 hours. Precipitation phenomena and distribution were documented qualitatively and quantitatively.

c. With P.R. Howell (Pennsylvania State University). "Microstructural Development in an Al - 4.5%Cu - 1.0%Li - 0.12%Zr Alloy." *The Proceedings of the International Conference on Aluminum Alloys*, Charlottesville, VA, 15-20 June 1986. (Presentation and Article)

We summarized our research done at Penn State on documenting the microstructural development of this promising Al-Cu-Li alloy as a function of aging time. The type and number of precipitates were identified using analytical electron microscopy techniques.

d. With P.R. Howell and M.H. Tosten (both of Pennsylvania State University). "The Nucleation of Al_3Li on Al_3Zr in Al-Li-Zr and Al-Li-Cu-Zr Alloys." *Journal of Material Science*. (Forthcoming Article)

We examined the nucleation aspect of the formation of duplex Al_3Li/Al_3Zr precipitates using classical nucleation theory. We showed that the energy barrier to nucleation is reduced when the Al_3Zr acts as a nucleation substrate for Al_3Li. Although strain energy may play a role in promoting nucleation of Al_3Li on Al_3Zr, we considered only the interfacial energy contribution.

e. With P.R. Powell and M.H. Tosten (both of Pensylvania State University). "On the Nucleation of O′ and T_1 on Al_3Zr Precipitates in Al-Li-Cu-Zr Alloys." *Journal of Material Science*. (Forthcoming Article)

We found that aging these alloys at 190° C resulted in the nucleation of precipitates on the Al_3Zr/matrix dislocations. In the majority of cases, the broad, coherent face of the O′ plates was in contact with the Al_3Zr precipitates. Similar evidence showed that nucleation of T_1 precipitates occurred on the Al_3Zr, but to a lesser extent than O′.

6. HINGER, Robert J., Captain and Assistant Professor

a. With Major Mark S. Ewing and Professor Arthur W. Leissa (Ohio State University). "Accuracy of the Reduced Bending Stiffness Representation of Laminated Composite Plates." (Research)

See J3a

b. With Major Mark S. Ewing and Professor Arthur W. Leissa (Ohio State University). "Comparison of the Reduced Bending Stiffness Method with Exact Theories of Bending, Buckling and Vibration of Antisymmetric Laminated Plates." (Research)

See J3b

c. Design of UV-18 Floater Bar, sponsored by 94th Air Training Squadron, USAFA, CO. (Consultation)

I designed a "floater bar" handle which mounts above the UV-18 parachute door. This allows up to four jumpers to exit safely at one time. The design meets certification requirements for USAFA and the Federal Aviation Administration.

7. LAMBERSON, Steven E., Major and Assistant Professor

a. Work in Progress

"Validation of Analysis and Control of Large Space Structures." (Research)

8. MARKSTEINER, Joseph P., Major and Instructor

a. With Captain David Nicholls. "C-130 Static Line Retriever Cable Tension Testing for Alternate Retriever Spools." Sponsored by Military Airlift Command, Airlift Center, Pope AFB, NC. (Report)

We designed, built and tested a cable tension measuring device and evaluated alternate designs for the static line retriever system on C-130 aircraft.

b. Work in Progress

"Airborne Testing of the Tension Measuring Devices and Airborne Evaluation of Alternate Retriever Designs." (Consultation)

9. NICHOLLS, David J., Captain and Assistant Professor

a. With Major Joseph Marksteiner. "C-130 Static Line Retriever Cable Tension Testing for Alternate Retriever Spools." Sponsored by Military Airlift Command, Airlift Center, Pope AFB, NC. (Report)

See J8a

b. With Majors Marvin Becker and Mark Ewing. "Strength, Toughness and Structural Damping Characteristics of Tough, Rubber-Modified Epoxy Interlayers in High-Stiffness Composites." Work sponsored by Frank J. Seiler Research Laboratory. (Research)

We investigated the use of rubber-modified epoxy interlayers as a method to improve the toughness and damping capability of composite materials.

c. Work in Progress

"Airborne Testing of Tension Measuring Devices and Airborne Evaluation of Alternate Retriever Designs." (Consultation)

"The Effect of Crack-Closure on Fatigue Crack Growth in Aluminum." (Research)

"Strength, Toughness and Structural Damping Characteristics of Tough, Rubber-Modified Interlayers in High-Stiffness composites." (Paper)

10. NUNEZ, Anthony C., Captain and Assistant Professor

a. With Cadet First Class Richard Donnelly, Mr. David Medina (Air Force Weapons Laboratory) and Captain Stephen Whitehouse. "An Evaluation of Simple Equipment-Response Models Against Data from the Multi-Unit Structure Test (MUST) Series." Presented at the Air Force Weapons Laboratory, Kirtland AFB, NM, 25 June 1986. Research sponsored by Frank J. Seiler Research Laboratory and Air Force Weapons Laboratory. Research conducted at Air Force Weapons Laboratory, 19 May-25 June 1986. (Presentation)

See J13b

11. ROBICHAUX, Leonard M., Captain and Instructor

a. With Paul A. LaGrace (Massachusetts Institute of Technology). "The Effects of Implanted Delaminations on the Tensile Behavior of Graphite/Epoxy Laminates." To be published as an FAA Technical Report. Work sponsored by the Federal Aviation Administration, Massachusetts Institute of Technology, June 1985-January 1986. (Thesis)

In order to examine impact to composite materials, we investigated the fracture of graphite/epoxy laminates implanted with materials to cause local delaminations. The effects on the stress-strain behavior and ultimate tensile strength were assessed both experimentally and anaytically.

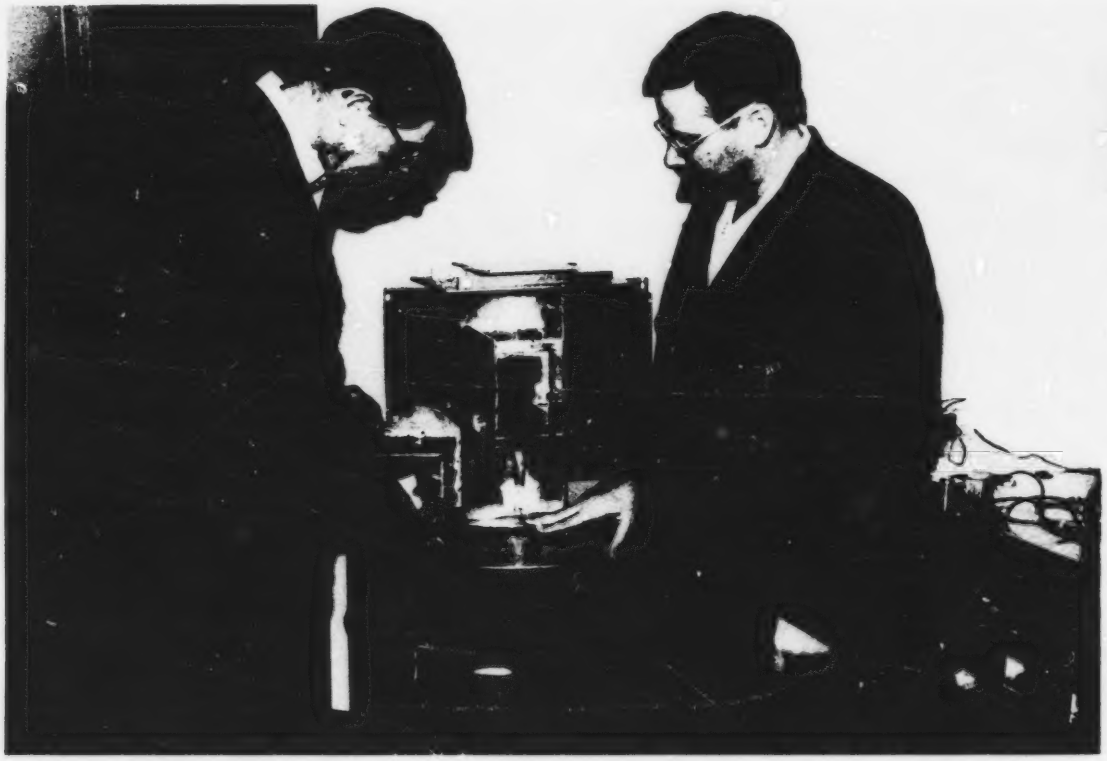
12. TURNER, Glon D., Major and Assistant Professor

a. "Materials Processing in a Micro-G Environment." Work sponsored by NASA-Lewis Research Center, Cleveland, OH. Research performed from 1 June-12 August 1986. (Research)

I was a NASA-American Society for Engineering Education (ASEE) Summer Faculty Fellow at Lewis Research Center. I performed solidification experimentation on space materials specimens. Experimental data from this summer research will be published in several upcoming symposiums.

b. Work in Progress

"Immiscible Alloy Solidification in Space." (Research)



Bob Wemmer and Major Turner assemble components for the Academy's space furnace.

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13. WHITEHOUSE, Stephen R., Captain and Associate Professor

a. With Mr. Gene Fossness (Air Force Weapons Laboratory). "Displacement Gage Development." Research sponsored by the Air Force Weapons Laboratory, Kirtland AFB, NM. Work performed at Air Force Weapons Laboratory from 17-25 June 1986. (Consulttion)

We derived equations of motion for a newly developed displacment gage. These equations were used to predict how the gage will perform.

b. With Cadet First Class Richard Donnelly, Mr. David Medina (Air Force Weapons Laboratory), and Captain Anthony Nunez. "An Evaluation of Simple Equipment-Response Models Against Data from the Multi-Unit Structure Test (MUST) Series." Presented at the Air Force Weapons Laboratory, Kirtland AFB, NM, 25 June 1986. Research sponsored by Frank J. Seiler Research Laboratory and Air Force Weapons Laboratory. Research conducted at Air Force Weapons Laboratory, 19 May-25 June 1986. (Presentation)

We used a design technique to determine if internal equipment should have failed in the MUST series. We compared the results of this determination to actual test results to evaluate the performance of the design technique.

c. With First Lieutenant Eric Matsumoto (Air Force Weapons Laboratory). "MUST-V Test Plan." Research sponsored by Air Force Weapons Laboratory, Kirtland AFB, NM. Work performed at Air Force Weapons Laboratory from 17-25 June 1986. (Consultation)

The fifth set of tests in the MUST series will evaluate the performance of newly designed combat work centers in blast-and-shock environments. This effort involved planning these tests.

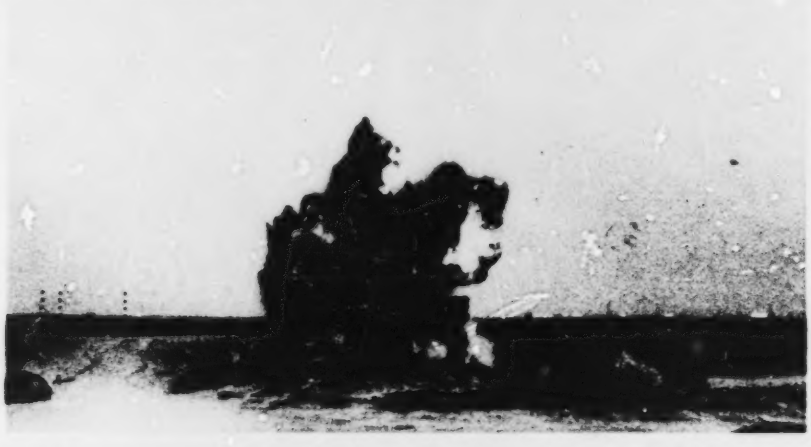
d. "Some Suggestions for Hardening Structures Against Car-Bomb Attack." *Proceedings for the Conference on Securing Installations Against Car-Bomb Attack*," Volume 3, pp 1075-1093, Arlington, VA, 15-17 May 1986. Research sponsored by Frank J. Seiler Research Laboratory. (Paper)

I discuss the importance of soil in attenuating airblast effects on structures, reference recent tests which may provide data regarding airblast loads on structures, and recommend the use of simplificd models for analyzing the response of structures to airblast loading.

e. Work in Progress

"An Evaluation of Simple Equipment-Response Models Against Data from the Multi-Unit Structure Test (MUST) Series." (Paper)

"An Evaluation of Simple Soil-Response Models Against Ground Shock Data from the Multi-Unit Structure Test (MUST) Series." (Paper)



The Air Force Weapons Laboratory conducts a test which provides data for Captain Whitehouse's blast and shock research.

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CHAPTER K

DEPARTMENT OF ENGLISH

Our mission is to teach clear, effective writing and to develop an understanding of our culture's best literature. In addition to our teaching roles, we maintain two professional programs for the Dean--*Discovery* and *Icarus* (our student creative writing publication). We also supervise our nationally-rated forensics team and present the Executive Writing Course, which is a program teaching effective, clear writing to all branches of the federal government. This year our traveling teams will make some forty trips and reach about 15,000 people.

1. AUBREY, James R., Lt Colonel and Associate Professor

a. With Major Richard L. Comer (McClellan AFB). "The Mavericks as Hero: Military Schools in American Popular Culture." *Air University Review* 37.1 (1985): 98-108. (Article)

Movies and books about military schools have always contained non-conformist heroes who are skeptical about academics, and their appeal probably reflects America's long-standing ambivalence toward both military and intellectual life. Examination of this sub-genre of literature reveals a shift toward a darker view of service academy life since the early 1960's, a development which seems to have anticipated the deglamorization of the military later in that decade.

b. Work in Progress

Joseph Heller's Annotations to *Catch-22*. (Article)

"True Taster": The Contest of Pope's "Epistle to Burlington." (Book)

The French Lieutenant's Woman: A Critical Edition. (Book)

Aldo Leopold and the American Naturalist Tradition: A Bio-Bibliography. (Monograph)

2. BANGS, Terry L., Lt Colonel and Associate Professor

a. With Lt Colonel William E. McCarron. "Teaching Writing Outside the Classroom." *The Bulletin of the Association for Business Communication*. (Forthcoming Article)

Based on a combined total of almost twenty years of teaching the Academy's Executive Writing Course, we offer some tips on how to make such outside-the-classroom presentations go more smoothly.

3. CANFIELD, John C., Captain and Instructor

a. "An Interview with Shirley Ann Grau." In *The Southern Quarterly*. (Forthcoming Article)

I interviewed Pulitzer-prize winning novelist Shirley Ann Grau. She discusses her thoughts on her own writing as well as on writing in general.

b. "A Trip to 'South' Maine." In *The Alabama Literary Review*. (Forthcoming Review)

In this article I discuss Dorothy Casey's first work, showing how her native land has influenced her writing.

c. "The Truth About Phoebe in Ellen Douglas's *The Rock Cried Out*." Southeastern Women's Studies Association, University of North Carolina, Greensboro, NC, 27 February-2 March 1986. (Presentation)

I argued that only by knowing Phoebe--a character who does not even live during the "real-time" action in the novel--can one discover the truth in this novel.

d. "Women Alone." In *The Southern Review* 22.4 (1986): 904-06. (Review)

In this review I argue that Shirley Ann Grau's collection of short stories, *Nine Women*, is a retrospective embodiment of previous fiction she has written. I conclude that Grau's vision as a writer has become more acute with time and that she continues to transcend the pejorative "regionalist" label.

e. Work in Progress

"Southerners Redefined: The Influence of Oxford on the New Critics." (Article)

4. CIAFFA, Robert J., Captain and Instructor

a. *Discovery: 1987 Dean of Faculty Research Publication*. Colorado Springs: USAF Academy, 1987. (Edited Work)

5. CRANE, Michael D., Captain and Instructor

a. "The House Behind the Cedars." In *Masterplots II*: American Fiction Series. Ed. Frank N. Magill. 4 vols. Pasadena, CA: Salem, 1986. 2: 748-53. (Forthcoming Review)

I provide a critical synopsis of Chesnutt's novel for high school, college, and lay reading audiences. I address the author's plot--crossing the racial color line and the ramifications of that act; characterization; major themes and meanings; and critical context. A short bibliography is also provided.

b. Work in Progress

With Major Jonathan R. Eller and Captain Bruce L. Jeffrey. *Joseph Heller, 1946-1986: A Bibliography*. (Book)

"The Good Soldier." (Article)

6. ELLER, Jonathan R., Major and Associate Professor

a. "Century Magazine," "Colliers," "Cosmopolitan Magazine," "Cyrus Curtis," and "William Dean Howells." *Encyclopedia USA*. Gulf Breeze, FL: Academic International Press, 1984. (Forthcoming Articles)

Taken as a group, these encyclopedia articles document the rise of the popular literary magazine during the Golden Age of American magazines (1870-1920). The Howells article documents his rise to prominence as author, editor, and dean of American Letters.

b. "A Critical Edition of William Dean Howells' *My Literary Passions*." Indiana University, Bloomington, IN, December 1985. (Dissertation)

In this five-chapter critical introduction I use Howells' letters and other documents to trace the way in which Howells shaped this literary memoir into a "reading autobiography." The introduction also examines and evaluates the reading record itself and the critical intention and standards it embodies. The edition includes a full text and textual apparatus.

c. *Preserving the Lambent Flame: Traditional Values and the USAF Officer Accession Program*, by Richard W. Stokes, Jr. *Armed Forces and Society* (Spring 1986), 478-80. (Book Review)

Stokes maintains that the traditional "officer-first" ethic is not the prime motivator for most new officers today. In this review I indorse his contention that officer candidates today may be more concerned with earning a marketable academic degree than with learning specialized skills and professional ethics.

d. Work in Progress

With Colonel Jack M. Shuttleworth. "*Catch-22* in England: A Bibliographical Checklist." (Article)

"*Catch-22*'s Back Door to Best Sellerdom." (Article)

With Captains Michael D. Crane and Bruce L. Jeffrey. *Joseph Heller, 1946-1986: A Bibliography*. (Book)

With Colonel Jack M. Shuttleworth. "Joseph Heller's *Catch-22*: A 25th Anniversary Bibliographical Checklist." (Article)

"The Literary Manuscripts of Joseph Heller." (Descriptive Finding List)

7. GASPAR, Charles J., Jr., Lt Colonel and Associate Professor

a. "The Aeroplanes at Brescia." In *Masterplots II*. Ed. Frank N. Magill. 4 vols. Pasadena, CA: Salem Press. 1: 34-37. (Forthcoming Review)

This is a critical review of a 1970 narrative by Guy Davenport. The author creates a fictional account of Franz Kafka's visit to, and impressions of, one of Europe's first important international airshows: The Grand Prix of Brescia, Italy, in 1909.

b. "Integrating Computers into the Classroom." Wyoming Conference on College English, Laramie, WY, 23-27 June 1986. (Presentation)

I chaired the presentations by panelists which examined the challenges in establishing computer-based composition programs. Problems and successes in three types of courses were discussed: introductory, intermediate, and advanced.

c. "The Vietnam War in Fact and Fiction." United States Air Force Academy Preparatory School, Colorado Springs, CO, 22 September 1986. (Presentation)

Using factual chronology, primary source documents, and literature, I introduce the complex events surrounding America's involvement in Southeast Asia. I also draw parallels with national politics in America.

d. Work in Progress

"The Vietnam Veterans Memorial and Vietnam War Literature: A Comparative Approach." (Paper and Article)

8. JEFFREY, Bruce L., Captain and Instructor

a. Work in Progress

With Captain Michael D. Crane and Major Jonathan R. Eller. *Joseph Heller, 1946-1986: A Bibliography*. (Book)

9. McCARRON, William E., Lt Colonel, Tenure Professor and Deputy Department Head

a. "Physics, Literature, and the Joy of Reading." Association of Departments of English Western Summer Seminar, USAF Academy, CO, 27 June 1986. (Paper and Presentation)

I discuss how contemporary physics and postmodernist literature have definite similarities.

b. With Major Doris A. Miller. "Supermarket Writing." In *Statement: The Journal of the Colorado Language Arts Society*. Volume XXI, No. 1, October 1985. pp. 12-17. (Article)

See K10a

c. With Lt Colonel Terry L. Bangs. "Teaching Writing Outside the Classroom." *The Bulletin of the Association for Business Communication*. (Forthcoming Article)

See K2a

d. Work in Progress

"Coincidental and Contrived Dates in *Gravity's Rainbow*." *Pynchon Notes*. (Note)

"The Power of Analogy in Engineering Writing." *Institute of Electrical and Electronics Engineers Newsletter*. (Article)

"Pynchon and Hobbes." *Notes on Contemporary Literature*. (Note)

"Pynchon and Hogarth." *Notes on Contemporary Literature*. (Note)

10. MILLER, Doris A., Major and Associate Professor

a. With Lt Colonel William E. McCarron. "Supermarket Writing." In *Statement: The Journal of the Colorado Language Arts Society*. Volume XXI, No 1, October 1985. pp. 12-17. (Article)

We reported on a presentation made to a teacher workshop on the teaching of writing in the classroom. We analyze the difference between generic, bland writing and personalized, dynamic student essays.

11. ROBERTSON, Joan A., Captain and Associate Professor

a. Work in Progress

"Nature Imagery in Archilochus' Cologne Fragment." (Article)

"Pindar's Pythian I and the Meanings of Pygy." (Article)

12. SHUTTLEWORTH, Jack M., Colonel, Permanent Professor and Department Head

a. "Grading Advanced Placement Exams." Advanced Placement Conference, University of Colorado, Colorado Springs, CO, 17-18 March 1986. (Paper and Presentation)

I conducted several workshops and presented a paper on various aspects of the advanced placement program in English for fifty high school teachers.

b. Advanced Placement Conference, Snowbird, UT, 11-12 August 1986. (Presentation)

I presented a paper on the advanced placement program in English and conducted a workshop for high school English teachers.

c. Work in Progress

With Major Jonathan R. Eller. "*Catch-22* in England: A Bibliographical Checklist." (Article)

With Major Jonathan R. Eller. "Joseph Heller's *Catch-22*: A 25th Anniversary Bibliographical Checklist." (Article)

"Military Use of Contemporary Airships." (Article)

13. SMITH, Herbert R., Major and Associate Professor

a. Brown, Kenneth. "Strategics: The Logistics-Strategy Link." National Defense University Press. (Edited Work)

b. Haffa, Robert. "Rational Methods, Prudent Choices: A Primer on Planning U.S. Military Forces." National Defense University Press. (Edited Work)

c. Kessler, Martha. "Syria: An Underestimated Partner." National Defense University Press. (Edited Work)

I edited the works listed in items a, b and c.

d. "Literature and Writing: Let Browning Lend a Hand." *Journal of English Teaching Techniques*. (Forthcoming Article)

Using Browning's "My Last Duchess," I present a demonstration of how literature can help to make students aware of the power and possibilities of word choice in composition.

e. Ostrovsky, A.N. *Rich Brides*. (Translation)

I reconstruct the first performed verison of this play and provide the first-ever English translation.

f. Work in Progress

"*Poor Brides, Rich Brides*: A Comparative Study of Techniques." (Article)

"Players and Playmaking: A Statistical Study of the Influence of Role Distribution on Dramatic Composition in Shakespeare's Early Comedies." (Article)

14. THOMSON, John M., Major and Associate Professor

a. "Perspective on Montaigne and His Times." Summer Institute sponsored by the National Endowment for the Humanities. Duke University, Durham, NC, 16 June-25 July 1986. (Conference)

I participated as one of twenty-five fellows in the Institute, whose purpose was to explore ways of teaching Montaigne, as well as Renaissance literature in general, to undergraduates.

15. WEADON, Mark P., Captain and Associate Professor

a. "Neo-Classical Romantic Poetry." Audiovisual Servies (DFSIV), USAF Academy, CO, July 1986. (Film)

I present a broad overview of significant literary trends and achievements from 1660 to 1850. We show this film as a TV lecture to students in the English Department's senior-level literature course.

b. Work in Progress

"Shakespeare's 'Man of Steel': Armor and Heroic Image in *Antony and Cleopatra*." (Article)

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CHAPTER L

DEPARTMENT OF FOREIGN LANGUAGES

Our mission is to help cadets develop a functional competence in the spoken and written language of a foreign country as well as an appreciation of the culture of foreign nations. Our research in the department improves our capability to fulfill our mission through study of the language-learning process and study of way to enhance that process.

1. BRIGHT, Duane E., Major and Tenure Associate Professor

a. "Extralinguistic Variables in the Listening Comprehension Process of Beginning Learners of Spanish." Ohio State University, Columbus, OH, September 1986. (Dissertation)

The listening comprehension process remains an area in need of a great deal of inquiry. In this study I tested the hypothesis that a provided pictorial extralinguistic context may have different linkages to a spoken utterance at the cognitive level of information processing. Specifically, I explored linkage relationships of presupposition and presupposition-implications between pictorial extralinguistic organizing referents and an utterance-to-be-comprehended.

2. BUSH, Michael D., Major, Deputy for Research and Tenure Associate Professor

a. "Putting High Technology to Work in Education." Air Force Conference on Technology in Training and Education, Montgomery, AL, 10-13 March 1986. (Presentation)

I presented several new technologies and explained how these can impact education. The main point I put forth is the challenge educators have to exploit these new developments properly.

3. CORNELIUS, Raymond D., III, First Lieutenant and Instructor

a. "Paul Scarron's Use of Laughter in the *Roman Comique*." Vanderbilt University, Nashville, TN, May 1986. (Thesis)

Given the mixed emotions on the subject of laughter in the seventeenth century and its direct relation to the acting profession, I analyze the presence and treatment of laughter in Scarron's work. I conclude that laughter must be included in any discussion of the theater debate.

4. CROTTY, Jill M., Major and Associate Professor

a. With Mr. Bertold L. Geiss (Director of Programs, Language Learning Center). "Interactive Videodisc Instruction at the United States Air Force Academy: An Update." Computer Assisted Language Learning and Instruction Consortium, U.S. Naval Academy, 13-15 May 1986. (Presentation and Demonstration)

We presented an update on the status of our Language Learning Center and discussed the "pedagogical fit" of interactive videodisc with our instructional goals.

5. LEMP, Richard W., Major and Assistant Professor

a. "Moliere and Medicine: Dissecting the Kaleidoscope." University of Arizona, Tucson, AZ, May 1986. (Dissertation)

This study views the elements of Moliere's medical comedy mixed into a kaleidoscope pattern. When separated, several areas emerge: historical representation, humor in the context of Galenic humorism, Moliere's specific use of a "medical language," his dramtic evolution from early medical farce to his last medical *comedies-ballets*, Moliere's organic unity involving law, medicine, and theology, and finally, Moliere's medical comedy compared with Antoine Artuad's *Theory of the Theater of Cruelty*.

b. Work in Progress

"Argan and Ubu: Black Humor and the Belly Lugh in Moliere and Jarry." (Presentation)

"The Language of Moliere's Medical Comedy." (Article)

"Le Poeme du Quinquina: La fontaine Ancien, La Fontaine Moderne." (Article)

"The USAF Academy: An Abbey of Theleme in March Time?" (Presentation)

6. NALABANDIAN, Jacques, Captain and Instructor

a. "Factors Influencing the Nineteenth-Century Arab 'Literary Revival.' " University of Minnesota, Minneapolis, MN, May 1986. (Thesis Presentation)

I offered a comparative assessment and analysis of elements which triggered the ninteenth-century Arab intellectual awakening.

b. "The Palestinian Liberation Organization: A Question of Legitimacy." University of Minnesota, Minneapolis, MN, May 1986. (Thesis Presentation)

I examined assumptions underlying the validity of the PLO's existence as a perceived legitimate representative organ of Palestinians.

7. PALA, Antonio L., Captain and Instructor

a. "Sight Readings as Comprehensible Input." Meeting at Air Academy High School of foreign language instructors from Colorado College, University of Colorado at Colorado Springs, and numerous local high schools, 18 October 1986. (Presentation)

I explained how to use the sight reading technique in class to benefit foreign language students.

b. Development of eleven sight reading texts for use in course text for Academy's Spanish 222. (Test Inclusion)

8. SMITH, W. Flint, Visiting Professor of Spanish

a. With M. Sue Barry (McCluer North High School, St. Louis). "Sight Reading and Second Language Learning." Indiana Foreign Language Teachers' Association, Indianapolis, IN, 1-2 November 1985. (Presentation)

We described and demonstrated materials from Spanish and French to teach the reading process in a second language without the use of a dictionary.

b. With M. Sue Barry (McCluer North High School, St. Louis), Sidney Pellissier (Purdue University), and Stephen Webb (Pattonville High School, St. Louis). "Sight Reading and Second Language Learning: Process and Materials." Central States Conference on the Teaching of Foreign Languages, Milwaukee, WI, 24-25 April 1986. (Presentation)

We defined comprehensible input and demonstrated examples from the literature on reading in a second language.

c. With Sidney Pellissier (Purdue University). "Using Sight Readings as Comprehensible Input." University of Northern Colorado Winter Conference, Greeley, CO, 13-14 February 1986. (Presentation)

We demonstrated materials in Spanish and French and related them to the psycholinguistic aspects of reading in a second language.

d. Work in Progress

Modern Media in Foreign Language Education, Volume I: Theory and Implications. (Book)

9. SUTHERLAND, Richard L., Captain and Assistant Professor

a. "Inexpensive Use of the Videodisc for Proficiency: An Attempt to Link Technology and Teachers." CALICO Journal, Vol. 4, No. 1, pages 67-80, September 1986. (Article)

I explained how videodisc technology can be used inexpensively in the second language classroom to achieve oral proficiency.

b. "Inexpensive Use of the Videodisc in the Traditional, Second Language Classroom." CALICO Institute at Brigham Young University, Provo, UT, 3, 10, 17, 24, 31 July 1986. (Presentations)

I demonstrated how the videodisc can be used inexpensively to enhance instruction in the second language classroom.

c. "Using the Videodisc to Learn German." 3rd Annual Deutsches Sprachfest. Broadmoor Hotel, Colorado Springs, CO, 1 May 1986. (Presentation)

I showed high school teachers and students how the videodisc could be used to accelerate learning German.

d. Work in Progress

"Using the Videodisc to Teach German in a Public High School." (Research)

10. TAMAME, Jose, Captain (Spanish Air Force) and Instructor

a. "The Armed Helicopter: Birth, Evolution, and the Helicopter as Escort," published in Spanish under the title "Con La Mejor Intencion" in *Revista de Aeronautica y Astronautica*, published by the Spanish Air Force, October 1986. (Article)

In this article, I discuss the necessity of better use of the armed helicopter in the military.

b. "Communicating in Spanish." *Deployment to Spain: Intercultural Eduation for the California Air National Guard.* USAFA-TN-86-1. (Article and Presentation)

I offer some basic language tools in Spanish to American military members to make their assignment/deployment to Spain more enjoyable and profitable.

c. "A Spanish Comment on the Culture of Spain." *Deployment to Spain: Intercultural Education for the California Air National Guard.* USAFA-TN-86-1. (Article and Presentation)

I present the Spanish mentality through a very brief historical and cultural perspective so that National Guard members on deployment to Spain will be better prepared for any differences they may encounter.

d. "The Spanish Military." *Deployment to Spain: Intercultural Education for the California Air National Guard.* USAFA-TN-86-1. (Article and Presentation)

In order for the Air National Guard to better understand their peers in the Spanish military, I summari.e the basic structure and history of the Spanish military.

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CHAPTER M

DEPARTMENT OF HISTORY

The research undertaken by the Department of History has three objectives: enhancing cadet education, contributing to the professional and scholarly development of this department's officers, and investigating topics relevant to the Air Force at large. Departmental research activities seek to achieve these objectives by exploring issues from a perspective which is informed and made more penetrating by historical inquiry.

1. BOROWSKI, Harry R., Lt Colonel, Tenure Professor and Deputy Head

a. "History of the Air Force Academy." Consortium on Revolutionary Europe, Tallahassee, FL, 28 February 1986. (Presentation)

I described the development and status of history courses as taught at the USAF Academy.

b. "Military Planning in the Twentieth Century." Proceedings of the Eleventh Military History Symposium, USAF Academy, CO, 10-12 October 1984. (Edited Work)

I edited the proceedings of the above symposium.

c. Work in Progress

"Biography, Air Force Leadership and Business Methods." (Article)

The Harmon Memorial Lectures, 1959-1987. (Edited Work)

2. CHIABOTTI, Stephen D., Major and Assistant Professor

a. Work in Progress

"The Glorified Link: Flight Simulators in Air Force Pilot Training, 1965-1980 " (Dissertation)

3. HOUCHIN, Roy F., III., Captain and Instructor

a. "Almost Stand-Off Scale: Dyna-Soar/Titan II: Step I." *Journal of the National Association of Rocketry*, June 1986, pp. 7-10. (Article)

I examined the technical decisions leading to replacement of the Titan I booster by the Titan II booster. This critical decision helped establish an unfortunate precedent for changing major components of the program, directly contributing to the project's cancellation.

b. Work in Progress

"Creating a Military Strategy for Space: The Impact of International and Domestic Political Affairs on the Dyna-Soar (X-20) Program." (Article)

"Military Strategy for Space: The Impact of Dyna-Soar, The X-20 Project." (Paper)

4. MAYSE, Chris M., Captain and Instructor

a. Work in Progress

"Centralization vs. Private Ownership." National Defense Colloquium. (Paper)

5. MEILINGER, Phillip S., Lt Colonel and Associate Professor

a. Work in Progress

Hoyt S. Vandenberg: The Life of a General. (Book)

6. NICHELSON, Brian J., Captain and Assistant Professor

a. Work in Progress

"Jet Engine Design: The Transition from Centrifugal to Axial." (Dissertation)

"The History of the Air Propeller." (Article)

7. REDDEL, Carl W., Colonel, Professor and Head

a. "The Soviet View of Human Resources in War." In *The Soviet Union: What Lies Ahead? Military Political Affairs in the 1980s.* Studies in Communist Affairs, Vol. 6. Washington, D.C.: U.S. Government Printing Office, 1985, pp. 415-31. (Article)

I examined the bases for the Soviet view of the role of the human factor in modern warfare.

b. "Seeing How They See Us." *Airman*, October 1986, pp. 14-15. (Article)

I wrote an abbeviated version of a set piece interview on Soviet views of Americans and the United States.

c. Work in Progress

"The Competition: The Nature and Purpose of Soviet Power." (Chapter)

"Proceedings of the Twelfth Military History Symposium." (Edited Work)

8. SHAW, Bryant P., Lt Colonel and Tenure Associate Professor

a. "Isolation and Progress: Africa and World History." USAF Academy, CO, 25 April 1986. (Presentation)

I presented an overview of the treatment accorded African history in world history textbooks.

b. Work in Progress

"Africa in World History: A Teaching Conference." (Edited Work)

The Force Publique in the Belgian Congo. (Book)

9. SMITH, Scott M., Major and Assistant Professor

a. "The Ideological Imperative for Approval--Or, 'Why Say Yes?' " National Defense Colloquium, USAF Academy, CO, 4 April 1986. (Presentation)

I examined the adaptations to Marxism made by Lenin, Stalin, Krushchev and Brezhnev as they sought to mold Marx's theories to fit the reality of the Russian condition.

b. "The Development of Soviet Airborne Doctrine on the Pre-war Period." Central Slavic Conference, Oklahoma State University, Stillwater, OK, 18-19 October 1986. (Presentation)

I discussed the development of Soviet airborne doctrine from the 1920s through its attempted implementation in the Great Patriotic War. I demonstrated how the Soviets make every attempt to learn from other countries' mistakes as well as their own.

c. "Soviet Invasion of Afghanistan: An Interpretation." Zebulon Pike Chapter of the Daughters of the American Revolution, Colorado Springs, CO, 14 October 1986. (Presentation)

I explained how the 1979 Christmas invasion of Afghanistan by the Soviet Union was not the first such invasion this century. This work also illustrated the incompatability of Marxism-Leninism with Islam.

d. *Transformation in Russian and Soviet Military History*. Special Bibliography Series, No. 72. USAF Academy, CO, October 1986. (Co-Editor)

e. Work in Progress

"Soviet Airborne Doctrine and Praxis, 1928-1986." (Report)

"Frunze-Trotsky Debates of 1921: A Reappraisal." (Article)

"Red Air Force Air-to-Air Tactics: A Short History." (Chapter)

10. TRETLER, David A., Lt Colonel and Associate Professor

a. "The Making of a Revolutionary General: Nathanael Greene, 1742-1779." Rice University, Houston, TX, May 1986. (Dissertation)

I investigate the origins of the military, political, social and philosophical thought of Major General Nathanael Greene and postulate how his ideas helped shape his performance as one of the principal military leaders of the American Revolution.

11. WEAVER, Larry A., Captain and Instructor

a. Work in Progress

"Joseph E. Davies and the Stalin Purge Trials, 1936-1938." (Article)

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CHAPTER N

DEPARTMENT OF LAW

Our primary mission is to provide cadets with an understanding of the relationship between law and social order. We help them develop sound decision-making abilities, prepare them for legal issues which they will encounter as officers, and introduce them to the kind of legal assistance available to help them deal with these issues. Our secondary mission is to provide legal assistance to cadets and faculty members. Thirdly, as Air Force lawyers, we have a responsibility to promote general legal education and add to legal literature on matters affecting the Air Force as a whole. Our research and presentations directly support these mission requirements. We continually update classroom material to provide the cadets with the latest information available in the constantly changing areas covered in their courses. Our research allows us to stay current in legal matters so we can provide quality legal assistance to our clients. Our presentations are designed to assist Air Force personnel in understanding their legal rights in our society, and in long-range financial and estate planning. Much of our current research is devoted towards preparations for our new legal studies major, which will be available for the graduating class of 1990.

1. BOWERS, Richard K., Jr., Major and Associate Professor

a. "Buying and Selling Your Home." (Presentation)

I acquaint the homeowner or prospective homeowner with the intricacies of buying or selling a home.

b. American Constitutional Law, Supplemental Cases. USAFA/DFL: USAFA. (Edited Work)

I compiled recent Constitutional law cases, to include those concerning the military, for use in Law 451, American Constitutional Law.

c. Work in Progress

"The American Legal System." (Edited Work)

2. GARDNER, Robert S., Major and Assistant Professor

a. "Government Money Remedies for Nonconforming Work." Air Force Institute of Technology, Wright-Patterson AFB, OH, July 1986. (Thesis)

I discuss and analyze the remedies available to the Federal Government when contracted work fails to conform to specifications as well as the positive and negative incentives to encourage conforming work.

3. HASSKAMP, Charles W., Captain and Assistant Professor

a. "Personal Financial and Estate Planning." (Presentation)

See N7a

b. Work in Progress

"Property." An Introduction to Law. (Edited Work)

Attorney General of the United States Edwin Meese addresses faculty members.

4. HILL, William A., Jr., Major and Assistant Professor

a. "Air and Space Law." (Presentation)

I provide a general overview of the customary law and treaty law of space.

b. Work in Progress

"Space Law." (Article)

5. KINEVAN, Marcos E., Colonel, Permanent Professor and Department Head

a. *Personal Estate Planning*. Englewood Cliffs, NJ: Prentice-Hall, Inc., 1980 (1986 Revision). (Book)

This book, which is used in our senior law course, is printed locally with permission from Prentice-Hall. The 1986 revision reflects changes necessitated by the 1986 Tax Reform Act, and recent developments in the areas of trust law, income shifting, investments, tax shelters, life insureance, annunity products and wills.

b. Work in Progress

"The Journal of Lt. John Bigelow, 10th Calvary, on the Texas Frontier." (Edited Work)

Militray Justice during the Frontier Indian Wars. (Book)

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6. MANSON, Harold C., Major and Assistant Professor

a. "Legal Aspects of Air Force Environmental Policy in Germany." (Report)

Sponsored by the Deputy for Health, Safety and Environment Office of the Secretary of the Air Force and by Headquarters, U.S. Air Forces in Europe, this report describes environmental laws which apply to Air Force activities in Germany and examines particular problems involving the German environment due to Air Force activity.

b. "Criminal Law." Law for Commanders. USAFA/DFL: USAFA. (Edited Work)

I provide a basic overview of criminal law as it is applied in the military through the Uniform Code of Military Justice.

c. Work in Progress

"Air Law." Law for Commanders. (Chapter)

7. NILSSON, Cheryl L., Major and Associate Professor

a. With Major Joseph J. Traficanti, Captain Conrad Von Wald, and Captain C.W. Hasskamp. "Personal Financial and Estate Planning." (Presentations)

These presentations focus on estate accumulation and distribution. They are designed to inform military personnel of the pitfalls they encounter while accumulating an estate. The presentations emphasize the role of planning for the future and cover some of the federal income and estate tax law problems unique to military personnel.

b. With Major Joseph J. Traficanti. "Personal Estate Planning for Senior Officers." USAFA/DFL: USAFA. (Pamphlet)

The pamphlet is designed to accompany the Personal Financial and Estate Planning presentations and gives the senior officer follow-on information helpful for future financial planning.

c. "SBP Analysis--Comparison of Survivor Benefit Plan (SBP) with Life Insurance." (Consultations)

This is a computer analysis designed to assist senior military personnel in deciding whether to purchase SBP or a commercial alternative to provide financial security for their survivors.

d. With Major Joseph J. Traficanti. "1986 Tax Reform Act Analysis." USAFA/DFL: USAFA. (Pamphlet)

This is a compilation of articles of particular interest to military taxpayers regarding the 1986 Tax Reform Act.

e. "Tax Treatment of Residential Property." USAFA/DFL: USFA. (Pamphlet)

This is a discussion of the tax treatment of residential rental property during rental and upon sale. The pamphlet outlines rental income and allowable expenses (including depreciation for property converted from a personal residence to rental, as well as the unique treatment of vacation homes.

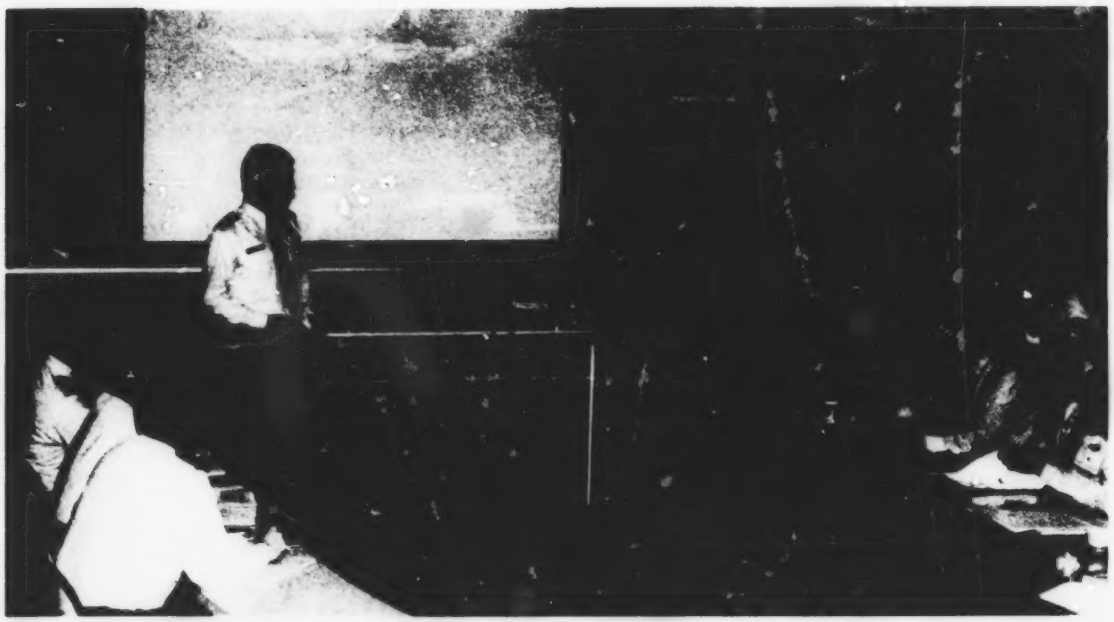
8. SPINNER, Frank J., Major and Associate Professor

a. "Administrative Law." Law for Commanders. USAFA/DFL: USAFA. (Edited Work)

I discuss substantive and procedural due process in military administrative actions.

b. Work in Progress

"The Military Chaplaincy and the Establishment Clause of the First Amendment." (Article)



Major Joe Traficanti and Major Cheryl Nilsson discuss survivors' benefits during a personal estate planning presentation.

9. TRAFICANTI, Joseph J., Major and Associate Professor

a. With Major Cheryl L. Nilsson, Captain Conrad Von Wald, and Captain C.W. Hasskamp. "Personal Financial and Estate Planning." (Presentations)

See N7a

b. With Major Cheryl L. Nilsson. "Personal Financial and Estate Planning for Senior Officers." USAFA/DFL: USAFA. (Pamphlet)

See N7b

c. With Major Cheryl L. Nilsson. "1986 Tax Reform Act Analysis." USAFA/DFL: USAFA (Pamphlet)

See N7d

10. VON WALD, Conrad M., Major and Assistant Professor

a. "Personal Financial and Estate Planning." (Presentation)

See N7a

b. "Torts." An Introduction to Law. USAFA/DFL: USAFA. (Edited Work)

I provide a compact overview of the law of torts, including discussion on intentional torts, negligence, strict liability, nuisance and tort remedies.

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CHAPTER O

DEPARTMENT OF MANAGEMENT

Our research program is primarily designed to prepare and motivate cadets for an Air Force career by integrating their learning with current Air Force missions. We use our research both to better prepare ourselves as teachers and for curriculum development.

1. AUSTIN, Walter W., Lt Colonel and Assistant Professor

a. Work in Progress

"An Empirical Study of the Population and Error Characteristics of Multilocation Accounting Populations." (Dissertation)

2. EVANCHICK, Michael A., Major and Assistant Professor

a. With Major Rita A. Moore. "Corporate Entrepreneurship: The New Educational Challenge." Association of Private Enterprise Education, San Antonio, TX, April 1986. (Presentation and Forthcoming Article)

We develop the four basic characteristics of entrepreneurship, focusing on the need to instill innovative problem-solving skills in management students.

b. Work in Progress

"A Transaction Cost Approach to Defense Contracting." (Dissertation)

"Strategic Decision-Making in Defense Contractors." (Article)

3. FRANCIS, Vernon E., Major and Tenure Associate Professor

a. "Aggregation of Network Flow Problems." University of California at Los Angeles, December 1985. (Dissertation)

I developed a framework for aggregation of network flow problems, including an important characterization of arc types. I further explained an aggregation procedure, as well as a methodology for generating sequences of successively restricted aggregate problems. Finally, I develop and implement an optimal algorithm.

b. Work in Progress

"Allocation of a Fixed Resource: An Optimal Algorithm and Applications." (Paper)

"Aggregation in PERT/CPM." (Paper)

4. LEMAK, David R., Major and Assistant Professor

a. "The Military Services Turnover and Retention Model: A New Perspective on Turnover." 94th Annual Meeting of the American Psychological Association, Washington, D.C., 23 August 1986. (Paper and Presentation)

I developed a conceptive model of the individual turnover process in military settings. The model integrated and extended the work of Mobley et al. (1978), and Price (1977) by refining some variables and defining new ones. I also provided a theoretical explanation for the phenomena of "satisfied leavers" and "dissatisfied stayers" in the military.

b. "The Multiple Constituency Power Differential Model of Organizational Effectiveness." Arizona State University, Tempe, AZ, July 1986. (Dissertation)

This project consisted of theory building and theory testing. I developed a conceptual model of organizational effectiveness based on response to constituency demands in terms of power. The model was then tested in a field study at a large public sector hospital. Empircal results demonstrated encouraging support for the model.

c. With Dr. Jeffery S. Bracker (Arizona State University). "A Strategic Contingency Model of Multinational Corporate Structure." (Forthcoming Article)

We developed a conceptual model which provided a theoretical explantion of the exploratory research study by Daniels, Pitts and Tretter (1980). The model specifies how a number of variables such as management orientation, product diversity, and dependence on foreign opertions are related to four types of multinational corporate structures.

d. With A.A. Kinicki, J.S. Bracker, R. Kreitner, and C.A. Lockwood (all of Arizona State Universiy). "Toward Socially Responsible Plant closings." (Forthcoming Article)

We report the results of a survey of CEOs, middle managers and employees displaced by a plant closing, as to what actions a firm should take prior to a close. Each group rank ordered twelve possible actions a firm could take, and results showed significant differences between the three groups. We also identify several companies which have included social concerns into their plant closing process.

5. MOORE, Rita A., Major and Instructor

a. With Lt Colonel Robert E. Pizzi. "A Dispersal Plan for the Air Force Bomber Fleet." (Presentation and Forthcoming Article)

We discuss an algorithm designed to stimulate an enemy submarine launched ballistic missile attack, with recommendations for optimal planet base combinations.

b. "Time Management." Civil Air Patrol Rocky Mountain Leadership School and Staff College, June 1986. (Presentation)

c. "Contemporary Issues in Management." Civil Air Patrol Rocky Mountain Leadership School and Staff College, June 1986. (Presentation)

d. "Communications and Creative Management." Wildwood Resources, Inc., Boulder, CO, September 1986. (Presentation)

e. With Major Michael A. Evanchik. "Corporate Entrepreneurship: The New Educational Challenge." Association of Private Enterprise Education, San Antonio, TX, April 1986. (Presentation and Forthcoming Article)

See O2a

f. Work in Progress

"Identifying Background Characteristics that Cause Male Officers Not to Accept Women in the Military." (Article)

"Towards a Simplified Model for Scheduling Military Aircraft Engine Overhauls." (Article)

6. PIZZI, Robert E., Lt Colonel and Tenure Professor

a. With Major Rita A. Moore. "A Dispersal Plan for the Air Force Bomber Fleet." (Presentation and Forthcoming Article)

See O5a

CHAPTER P

DEPARTMENT OF MATHEMATICAL SCIENCES

Our research supports the overall research objectives of the Academy and the Air Force, introduces cadets to basic and applied research on-going within the Air Force, and contributes to the academic integrity of the mathematics faculty.

1. ALLGAIER, Darrell E., Captain and Associate Professor

a. With Dr. Richard Haberman (Southern Methodist University). "Slowly Varying Solitary Wave Tails: Focusing, Cusped Caustics, Wave Number Shocks and Birth of Tails." *SIAM Journal of Applied Mathematics*, Vol. 45, No. 6, December 1985, pp. 919-927. (Article)

The method of characteristics predicts triple-valuedness for the wave number of the tail of study-varying solitary waves and solitons. A thin focusing region near a cusped caustic (envelope of characteristics) satisfies the heat equation, whose solution involves an exponential-type Pearcey integral. After focusing, two tails of different wave number are superimposed, representing a birth of a solitary wave tail. One tail dominates, and thus a wave number shock is generated, separating two different solitary wave tails, propagating at the shock velocity determined from conservation of waves.

b. "Wave Number Shocks for the Tail of Korteweg-DeVries Solitary Waves in Slowly Varying Media." Southern Methodist University, Dallas, TX, May 1986. (Dissertation)

I examine all the physical cases of Kortweg-DeVries solitary waves propagating in a slowly varying medium. In many such cases energy focuses in front of the wave predicting a triple-valued wave number. I determine uniform asymptotic solutions which show that this triple-valued wave number actually determines a wave number shock rather than generating new soiitary waves as had been conjectured in the previous research.

c. Work in Progress

"Uniform Asymptotic Korteweg-DeVries Solutions for Caustic Regions." (Article)

2. ANDREW, John M., Captain and Assistant Professor

a. Work in Progress

"A Comparison of USAFA Graduates vs. Non-USAFA Graduates in AFIT Programs." (Presentation)

3. BOUDOT, James R., Captain and Instructor

a. Work in Progress

"Automated Math Placement Model." (Research)

4. CLECKNER, William H., IV (USA), Major and Instructor

a. "Tactical Evidential Reasoning: An Application of the Demptser-Shafer Theory of Evidence." Naval Postgraduate School, Monterey, CA, October 1985. (Thesis)

I create a decision aid for the intelligence analyst. The knowledge base of the aid uses the Dempster-Shafer theory to combine evidence from various intelligence sources to predict enemy intentions.

b. With Lt Colonel Stephen Schmidt and Dr. (Colonel) Harry Wetzler (DODMERB). "Enhancement of Health Index Prediction." Department of Defense Medical Evaluation Review Board, USAFA, CO, November 1986. (Research)

We develop a new procedure to maximize the predictability of a Health Index based on lifestyles data from surveys conducted by U.S. Dept of Health, 1979-1980. The procedure is based on linear regression and automatic interaction detection.

5. CURRY, Thomas F., Major and Instructor

a. "Time Series Prediction of Hurricane Landfall." University of Texas, Austin, TX, May 1986. (Dissertation)

I show North Atlantic hurricane and tropical storm landfalls can be accurately predicted by modeling the storm track as a bivariate (latitude and longitude) fifth-order autoregressive process.

b. Work in Progress

"Time Series Prediction Accurary Compared to Climatology and Persistence." (Paper)

6. DEBLOIS, Bruce A., Captain and Instructor

a. With Captain Milton Johnson. "An Investigation and Application of a New Maintainability Measure: Mean Equipment Corrective Maintenance Time Required to Support a Unit Hour of Operating Time (MTUT)." Department of Mathematical Sciences, United States Air Force Academy, Colorado Springs, CO; Rome Air Development Center (RADC/RBET), Griffiss AFB, NY. (Report and Presentation)

See P12a

7. HAUSSERMANN, John W., IV (USN), Lieutenant JG and Instructor

a. "Typical Properties of Continuous Functions." A condensation of my dissertation: "Generalized Porosity Characteristics of a Residual Set of Continuour Functions." Colorado College, Colorado Springs, CO, 14 March 1986. (Paper and Presentation)

Most students believe that polynomial, trigonometric, and exponential functions display behavior that is represetnative of all continuous functions. I discussed and related this misconception to such topics as differentation, Hansdorff dimension, and porosity.

b. Work in Progress

"Chaotic Dynamical Systems and Fractals." (Research)

8. HEADLEE, Christopher R., Captain and Instructor

a. With Captains William L. James and Michael J. Nielsen. "Problem Generators on Zenith Z-248 Computers in Support of Core Mathematics." Department of Mathematical Sciences, USAF, CO. (Research)

Precalculus (Algebra and Trigonometry) and Calculus (Integration and Differentiation) packages generate random problems for cadets to solve. Problem types follow problems seen in core math courses. Answer possibilities include multiple choice and real number input. We use graphs and special character fonts.

b. Work in Progress

"Computers in Core Math Revisited." (Paper and Presentation)

"Differential Equation Problem Generator." (Research)

"Additions to Precalculus and Calculus Problem Generators." (Research)

9. HOYLE, Stephen C., Major and Associate Professor

a. "A Single-Phase Method for Quadratic Programming." Stanford University, Stanford, CA, January 1986. (Dissertation)

I formulate and test a new single-phase quadratic programming method. This method can be applied in the area of nonlinear programming, which uses sequential quadratic programming, and in the area of sensitivity analysis involving the constraints.

10. JAMES, William L., Captain and Assistant Professor

a. With Captains Christopher R. Headlee and Michael J. Nielsen. "Problem Generators on Zenith Z-248 Computers in Support of Core Mathematics." Department of Mathematical Sciences, USAFA, CO. (Research)

See P8a

11. JOHNSON, Jeryl W., Captain and Instructor

a. "Jointly Optimal Production and Inspection Scheduling for Production Systems Influenced by Learning." North Carolina State University, Raleigh, NC, May 1986. (Thesis)

I developed unified production cost models for production systems affected by learning and forgetting. Model 1 considers variable learning/fixed forgetting, and Model 2 considers variable learning and forgetting. The models are formulated for solution as hierarchical dynamic programming problems, and optimal production lot sizes are calculated.

12. JOHNSON, Milton H., Captain and Instructor

a. With Captain Bruce Deblois. "An Investigation and Application of a New Maintainability Measure: Mean Equipment Corrective Maintenance Time Required to Support a Unit Hour of Operating Time (MTUT)." Department of Mathematical Sciences, United States Air Force Academy, Colorado Springs, CO; Rome Air Development Center (RADC/RBET), Griffiss AFB, NY. (Report and Presentation)

Maintainability is often measured by Mean Time to Repair (MTTR). We define a new measure for maintainability to better show the true effects of component failure rates and repair rates over the maintenance system. We also analyze and investigate current maintainability data with the new measure. Finally, we show how a maintainability optimization problem can be formulated.

b. Work in Progress

"Application of Differential Equations to Atmospheric Diffusion." (Research)

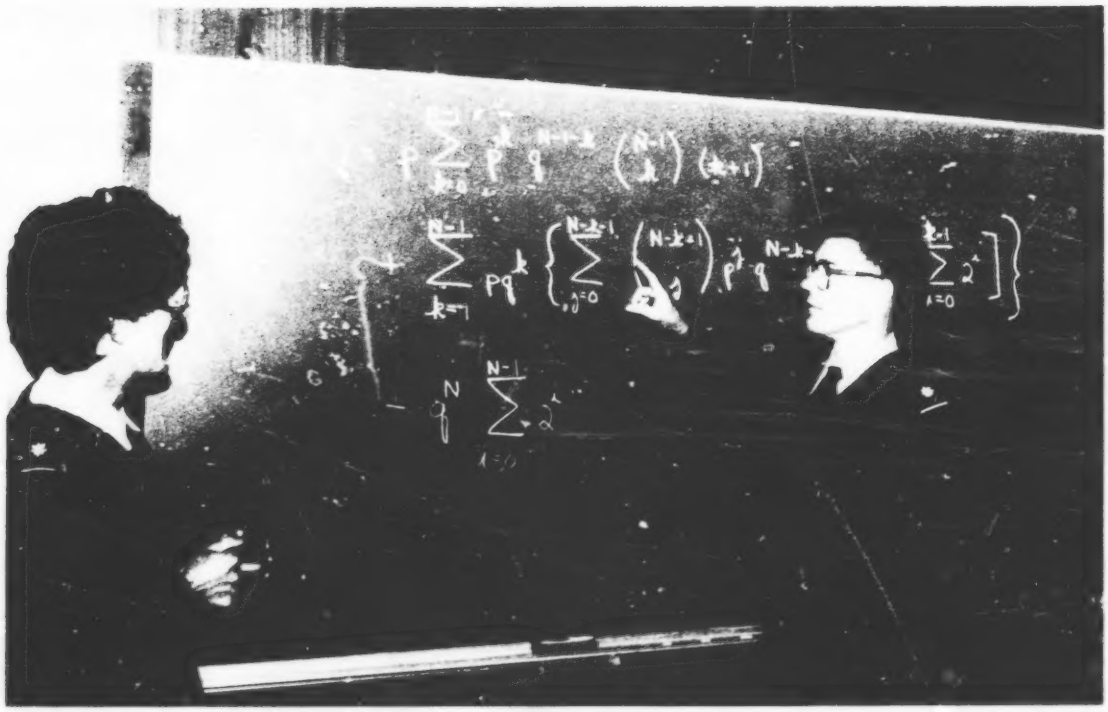
13. KIEMELE, Mark J., Major and Associate Professor

a. "A Sizing and Timing Analysis of an Integrated Computer Network Simulator." 1985 Winter Simulation Conference, San Francisco, CA, 11-13 December 1985. (Presentation)

I addressed the performance characteristics of a computer-communication network that integrates both voice and data traffic on the backbone of the network. Data was analyzed to determine simulation running time needed to reach steady state and to size the input parameter ranges that correspond to feasible network performance.

b. With Dr. Udo W. Pooch (Texas A & M University). "A Sizing and Timing Analysis of an Integrated Computer Network Simulator." *The 1985 Winter Simulation Conference Proceedings*, The Institute of Electrical and Electronics Engineers, December 1985, pp. 322-330. (Paper)

We develop a methodology to determine simulator run-time needed to reach steady state and to determine input parameter ranges that correspond to feasible network performance.



Major Kiemele explains the application of mathematics to a Cryptographic Scheme.

Captain Johnson uses the USAFA library's automated information retrieval system.

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c. "Crytographic Schemes to Conceal Messages and Protect Data." 1986 Annual Conference of the National Council of Teachers of Mathematics (NCTM), Washington, DC, 1-4 April 1986. (Presentation)

I presented how the algorithms for the Data Encryption Standard (DES) and Rivest-Shamir-Adleman (RSA) encryption schemes can be used to motivate the study of mathematics.

d. "The Math 211 Experiment." Dean's Time, USAFA, 17 April 1986. (Presentation)

I presented the results of an experiment which compared the use of computer-aided instruction with the traditional classroom approach in the review of differential and integral calculus.

e. Work in Progress

"An Experiment to Evaluate a Calculus Problem Generator." (Report)

"A Peak-Finding Algorithm for Noisy Data." (Paper)

14. KNEPELL, Peter L., Lt Colonel and Tenure Associate Professor

a. "Learning and Instructional Styles at a Military Academy." National Council of Teachers of Mathematics Annual Meeting, Washington, DC, April 1986. (Presentation)

I led a discussion of the results of a learning style and instructional style inventory taken of students and instructors of math here at the Academy. Observations led to some changes in the way the department runs its professional development programs from new instructor training to supervisor workshops.

b. "Exhibits and Demonstrations." *Impacts of Microcomputers on Operations Research*. New York: North Holland, 1986. (Chapter)

I contributed this chapter to the proceedings of a symposium sponsored by the Computer Science Technical section of the Operations Research Society of America held 20-22 March 1985.

15. McGILLEN, Donald J., Captain and Instructor

a. Work in Progress

"Application of Differential Equations to Atmospheric Diffusion." (Research)

16. MITCHELL, Tony L., Major and Assistant Professor

a. Work in Progress

"Fault Tolerant Network Topologies." (Paper)

17. MURROW, Richard C., Lt Colonel and Assistant Professor

a. "Frozen Orbits--Near Constant or Beneficially Varying Orbital Parameters." University of Colorado, Boulder, CO, May 1986. (Thesis)

I analyze physical understanding, theories, and mathematical formulation for different types of frozen orbits. Included in the frozen orbit concept are minimum-altitude variation arc, various categories of low-Earth orbits such as sun-synchronous, and geosynchronous orbits.

b. Work in Progress

"Minimum Altitude Variation Arcs." (Paper and Presentation)

Captain Nielsen learns about motorized glider operation as part of her study for Cadet Operations.

18. NIELSEN, Donna S., Captain and Instructor

a. "An Analysis of the Number of Motorized Gliders Required to Satisfy both Cadet and Instructor Training Sorties." Cadet Operations, USAFA, CO. (Consultation)

A Monte Carlo computer model simulates the daily operations of the motorized gliders. Sensitivity analysis shows the impact of the number of motorized gliders, weather cancellations, and maintenance on the ability to satisfy sortie requirements.

19. NIELSEN, Michael J., Captain and Instructor

a. With Captains Christopher R. Headlee and William L. James. "Problem Generators on Zenith Z-248 Computers in Support of Core Mathematics." Department of Mathematical Sciences, USAFA, CO. (Research)

See P8a

20. SCHMIDT, Stephen R., Lt Colonel and Associate Professor

a. With Dr. Samuel R. Houston (University of Northern Colorado). "Predicting College Dropouts by Combining Automatic Interaction Detector and Discriminant Analysis." USAFA TR-86-5, United States Air Force Academy, Colorado Springs, CO. (Research)

We use data from the Academy graduating classes of 1983 and 1984 to develop a model to classify dropouts based on admissions data. The model incorporates automatic interaction detector procedures which split the original data into homogeneous subgroups.

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b. With Major William H. Cleckner, IV, (USA) and Dr. (Colonel) Harry Wetzler (DODMERB). "Enhancement of Health Index Prediction." Department of Defense Medical Evaluation Review Board, USAFA, CO, November 1986. (Research)

See P4b

c. "Critique of Statistical Aspects of AFR 25-5 and Related Software." (Presentation to AFMEA, Randolph AFB, TX and Paper for HQ MSAF/DCS)

I critique chapters 32 and 33 of AFR 25-5 and the micro-software package used to make Air Force manpower allocations. Discrepancies are noted and recommendations presented.

d. Work in Progress

"Automation of Math Placement." (Research)

21. VETTER, James C., Captain and Associate Professor

a. Work in Progress

"A Numerical Study of Optical Phase Conjugaton in a Stimulated Brillouin Scattering Cell." (Article)

22. WALSH, Stephen J., Captain and Instructor

a. "On the Modeling of a Large-Scale Electro-Optic System." University of New Mexico, Albuquerque, NM, May 1986. (Thesis) Air Force Weapons Laboratory, Kirtland AFB, NM. (Report)

Using structural decomposition, I obtained a large-scale realization model for a three-aperture bench laser system. This 208th order realization model represents a valuable investigative tool for further control analysis and phased-array experimental research.

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CHAPTER Q

DEPARTMENT OF PHILOSOPHY & FINE ARTS

The department's research is focused in two areas. The first is in the area of professional ethics. Here, various members of the department write, speak to classes at professional military education institutions throughout the country, and speak to the general public about the importance of maintaining high ethical standards in the professions in general and in the military in particular. The second focus of research is into the moral constraints on warfare and national security policy. Here also, a combination of publications and speaking engagements, both to professional military audiences and to the general public, make the results of our research available to others. Both of these topics, of course, are also a prominent part of classroom instruction in the core ethics course.

Aristotle (Captain Gannon) introduces cadets to the science of ethics.

1. HUDLIN, Charles W., Major and Associate Professor

   a. "International Terrorism." Peace Education Fund, Santa Fe, NM, 26 October 1985. (Presentation)

This talk was part of a panel discussion on the problem of international terrorism and what might be done about it. It emphasized the role of moral considerations in making policy decisions on this issue.

2. KANKIEWICZ, Gary, Major and Assistant Professor

   a. "Fraternization: Some Moral Considerations." *USAFA Journal of Professional Ethics*, 1985: 24-31. (Article)

I argue that the difference in the oath of office between the enlisted man and officer is sufficient grounds for enforcing a sharp break between the two groups in the question of fraternization.

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3. KEMP, Kenneth W., Captain and Assistant Professor

a. "Against a Policy of 'No First Use' of Nuclear Weapons." Boulder County Nuclear War Committee Forum, Boulder, CO, 17 October 1986. (Lecture)

I presented the case against adopting a public pledge not to be the first nation to use nuclear weapons.

b. "Anthony Kenney's *The Logic of Deterrence*." (Forthcoming Review)

I review a book which makes the argument I criticized in Q3d.

c. "The Moral Case for the Strategic Defense Initiative." In *War, Morality and the Military Profession*, Malham M. Wakin, ed., 509-516. (Article)

I argue that strategic defense, if technically possible, is morally preferable to the present policy of deterrence and to policies of immediate disarmament.

d. "Nuclear Deterrence and the Morality of Intentions." (Forthcoming Article)

I argue that the most common deontological argument against nuclear deterrence (namely, that deterrence is wrong because it involves a conditional intention to kill innocent people) fails.

e. "Pluto and the Patterns of Planetary Discovery." (Forthcoming Article)

I argue that the discovery of Pluto was more like that of Uranus (the result of a comprehensive survey of the skies) than like that of Neptune (the result of a brilliant and successful mathematical prediction).

f. "Speculation and Creativity in the Natural Sciences." Engineering "Brown Bag" Colloquium, USAFA, 6 March 1986. (Presentation)

I emphasize that natural science does not progress as a result of sobriety and caution on the part of its practitioners. New insights depend crucially on scientists coming up with imaginative possibilities and sticking with them until evidence can be found to support them.

g. "The Strategic Defense Initiative--The Moral Issues." Society for Christian Philosophers meeting, American Catholic Philosophical Association, Baltimore, MD, 5 April 1986. (Presentation)

I argue the same basic point as in Q3c, but in a different way.

h. Work in Progress

Logic: A Brief Guide to the Art of Reasoning. (Book)

4. LINN, Dennis, Captain and Assistant Professor

a. "Lifeline: Above and Below." Smithsonian Air and Space Museum. (Acrylic Painting)

5. LOSIEWICZ, Paul, Lieutenant (USNR) and Assistant Professor

a. "Maritime Strategy." Air Command and Staff College Seminar, USAFA, 28 February 1986. (Presentation)

I gave an overview of current U.S. Naval strategy.

o. "The Serpent's Burden: Amorality in Strategy and Tactics." Department of Philosophy and Fine Arts Colloquium, USAFA, 10 January 1986. (Presentation)

I explore the need to evaluate our strategic and tactical planning from an amoral reference perspective and to evaluate the limits of the amoral reference in strategic decision-making.

Captain Linn makes a point using the color wheel.

Major McCamley addresses his Fine Arts 458 students.

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6. MARTINEZ, Ramon, Captain and Assistant Professor

a. "Ethical Considerations in the Professions." Senior Executive Seminar, U.S. Office of Management, Denver, CO, 11 July 1986. (Presentation)

I argued that the professions, especially those concerned with public administration, are not morally neutral. I further discussed how this requires that public officials commit themselves to the cultivation of moral virtues.

7. TOWER, Patrick, Captain and Assistant Professor

a. Work in Progress

"Dewey's Critique of Hegel." (Dissertation)

8. WAKIN, Malham M., Colonel, Permanent Professor and Department Head

a. "The Air Force Academy Today." Washington (D.C.) Area Parents' Club, 12 October 1985. (Presentation)

I discussed the mission of the Air Force Academy.

b. Lectures on Morality and War.

i. "The Principles of Just War." Our Lady of the Pines Catholic Church, Colorado Springs, CO, 9 February 1986.

ii. "Just War, Nuclear Deterrence, and the Strategic Defense Inititive." Pace University, New York, NY, 9 March 1986.

iii. "Just War, Nuclear Deterrence, and the Strategic Defense Initiative." Boston University, Boston, MA, 21 November 1985.

iv. "What is Our Best Defense?" Trinity Conference, Santa Fe, NM, 27 June 1986.

In these lectures I emphasize the moral unacceptability of "total war," defend the classical principles of "just war" theory, and comment on moral concerns associated with a strictly defensive system which could emerge from the SDI.

c. Lectures on Professional Ethics.

i. "Duty, Honor, Country." Freshman Class Colloquium. United States Military Academy, 20 November 1985.

ii. "Ethical Responsibilities in the Military." Armed Forces Staff College, Norfolk, VA, 18 November 1985 and 7 April 1986.

iii. "Ethics and Leadership." U.S. Army War College, Carlisle Barracks, PA, 18 June 1986.

iv. "Ethics and Professionalism in Military Leadership." Air National Guard Senior Commanders' Orientation Symposium, Andrews AFB, MD, 12 February 1986.

v. "Integrity and the Military Image: Is Public Affairs Responsible?" USAFA, 17 March 1986.

vi. "Lieutenants Can Make a Difference." Senior Class Assembly, USAFA, 9 April 1986.

vii. "Medical and Military Professionalism." Hospital Commanders' Course, Sheppard AFB, TX, 25 September 1986.

viii. "The Military Profession Today." USAF ROTC, University of Northern Arizona, Flagstaff, AZ, 18-19 April 1986.

ix. "Perspectives on Military Ethics." Squadron Officer School, Maxwell AFB, AL, 19 August 1986.

x. "Professional Ethics." Air Command and Staff College, Maxwell AFB, AL, 15 September 1986.

xi. "Professional Ethics." Medical Resource Management Symposium, Sheppard AFB, TX, 13 May 1986.

xii. "Pursuing Excellence." Quarterly Airman's Award Luncheion, USAFA, 25 April 1986.

xii. "The Role of Ethics in the Military Profession." USAF ROTC, University of Colorado, Colorado Springs, CO, 11 March 1986.

xiv. "Why Study Ethics?" Canadian Forces Command and Staff College, Toronto,Ontario, 11 September 1986.

xv. "Why Study Ethics?" U.S. Army War College, Carlisle Barracks, PA, 7 August 1986.

In these lectures I emphasize the importance of good character to the profession of arms. I discuss what virtues are necessary to good character and why they are important if the military services are to fulfill their responsibility to society.

d. "Mathematics and Reality." Department of Mathematical Sciences, USAFA, 1 May 1986. (Presentation)

I considered the nature of truth in mathematics, the status of axiomatic systems, the construction of "artificial" geometries, and the relationship between mathematics and the physical universe.

e. "Proofs for the Existence of God." St. Mary's High School, Colorado Springs, Co, 16 December 1985. (Presentation)

In this talk I explored some of St. Thomas Aguinas' proofs for the existence of God.

f. "The Role of Liberal Education in the Public Professions." Regional History Conference, USAFA, 25 April 1986. (Presentation)

I raised the question of the kind of education we should require of our practitioners in the public professions, especially government, medicine, law, teaching, and the military. I emphasized the role of the liberal arts in dealing with war and understanding the human condition, critical thinking, and important value questions.

g. *War, Morality and the Military Profession*. Second edition. Boulder, CO: Westview Press, May 1986. (Book)

This is a revised edition of an anthology first published in 1979. It incorporates articles published since the appearance of the first edition and includes more explicit treatment of certain topics (in particular, the morality of nuclear deterrence). It is used in the USAFA Philosophy core course each year as well as in professional military education schools, ROTC, and civilian schools throughout the country.

9. ZINK, Jeffrey, Captain and Instructor

a. "Philosophy of Science." Summer Scientific Seminar, USAFA, June 1986. (Pesentation)

This class for select high school students discussed the foundation of axiom systems, as well as scepticism and the problem of induction.

b. "Teaching Ethics at the Military Academy." Discipuli Conference, University of Southern California, Los Angeles, CA, 15 April 1986. (Presentation)

I describe the teaching methods and procedures used by the Department of Philosophy and Fine Arts in preparing cadets for the moral challenges they will face in military life.

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CHAPTER R

DEPARTMENT OF PHYSICS

Our research is designed to motivate cadets, keep our instructors current, and support Air Force research and development efforts. Although we have a diverse program, the majority of our research is in two main areas. The first area, the Computer Learning Laboratory, provides computer testing, computer record keeping, Socratic dialog, and physical simulations, all using color graphics and interactive terminals. The second area, the Laser Laboratory, concentrates on laser-solid interaction studies and laser kinetics. We also have an observatory and a radiation laboratory in support of theoretical space physics studies. All of our research projects are selected to provide cadets and faculty the opportunity to work on timely problems and to support long-range Air Force goals.

1. ATCHINSON, Walter L., Captain and Assistant Professor

a. Work in Progress

"Computer-Aided Demonstrations for Physics Instruction." (Research)

"Relativistic Electron Beam Induced Ultraviolet Lasing in N_2 at Atmospheric Pressures." (Research)

2. BEASON, J. Douglas, Captain and Associate Professor

a. "A Simple Method for Computing the Relativistic Compton Scattering Kernel for Radiative Transfer." Lawrence Livermore National Laboratory, March 1986. (Colloquium)

I presented the reduction of the differential scattering kernel averaged over a Maxwellian electron distribution to a single integral. I expressed this integral in two series representations: a power series convergent and stable everywhere and an asymptotic series good for backscatter.

b. Work in Progress

"Coupling of Radiative Transport, Chemical Kinetics, Hydrodynamics, and Laser Radiation in a Two-Dimensional Lagrangian Framework." (Research)

3. BLOOMER, Raymond H., Jr., Major and Tenure Professor

a. With Captain Mark V. Tollefson. "More Accurate Time from the Heathkit Most Accurate Clock." *Publications of the Astronomical Society of the Pacific*, No. 98, May 1986. (Article)

A commercial clock was modified to increase the precision of its output to a computer through a standard interface.

b. With Lt Colonel David J. Evans and Major Thomas F. Tascione. "Teaching Modern Physics to Social Science and Humanities Students." American Association of Physics Teachers Meeting, Atlanta, GA, January 1986. (Presentation)

Tracking of core physics courses allows tailoring to the needs and expectations of students. We observed great success in improved attitudes and motivation.

c. With Lt Colonel William E. McCarron (DFENG). "Team Teaching Literature and Science." Department of English Summer Seminar, United States Air Force Academy, Colorado Springs, CO, June 1986. (Presentation)

Based on several years of experience with honors versions of senior modern physics and literature courses, we point out how higher levels of thinking can be generated in both disciplines using team teaching.

4. BOHN, Courtlandt L., Captain and Associate Professor

a. With Majors E. Jumper, J. Covick and Larry McKee (all of Air Force Institute of Technology), J. Jackson (Kamar. Sciences), and Captain Michael L. Crawford "Laser-Supported Detonation Waves in an Obliquely Incident Beam." First International Laser Science Conference, Dallas, TX, November 1985. (Paper)

We report on the observation of laser-supported detonation waves in an obliquely incident laser beam on a metallic surface.

b. With Majors E. Jumper, J. Covick and Larry McKee (all of Air Force Institute of Technology), J. Jackson (Kaman Sciences), and Captain Michael L. Crawford. "Mechanisms for Thermally-Enhanced Target Coupling by Repetitively-Pulsed Lasers Revisited." Fourth Fluid Mechanics, Plasma Diagnostics, and Laser Conference, Atlanta, GA, May 1986. (Paper)

We report on our continued efforts to understand the mechanisms underlying the thermally-enhanced coupling between various repetitively-pulsed lasers and metallic surfaces.

Captain Boyer discusses the results of a Monte Carlo simulation of a permanent magnet electron spectrometer.

5. BOYER, Kenneth G., Captain and Assistant Professor

a. With A.D. Hancock, R.A. Hitko and Q. Klingler (all of EG&G, Los Alamos Office), N.S.P. King and A.W. Obst (both of Los Alamos National Laboratory). "A Permanent Magnet Proton Spectrometer." American Physical Society Meeting, Washington, D.C., April 1986. (Presentation)

We developed a compact spectrometer using cobalt-samarium permanent magnet material for observing 10-20 MeV protons. The spectrometer consists of a single quadrupole element followed by a dipole element. The particles are detected in the focal plane by solid state detectors and an electro-optical system.

b. Work in Progress

"A High-Resolution Permanent Magnet Electron Spectrometer for 1-21 MeV Electrons." (Consultation)

"High-Resolution Permanent Magnet Proton Spectrometers for 7-21 MeV and 28-52 MeV Protons." (Consultation)

"A PINEX Monochromatic Permanent Magnet Electron Spectrometer Design Study." (Consultation)

"A THREX Permanent Magnet Proton Spectrometer Design Study."

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6. CRAWFORD, Michael L., Captain and Associate Professor

a. With Majors E. Jumper, J. Covick and Larry McKee (all of Air Force Institute of Technology), J. Jackson (Kaman Sciences), and Captain Courtlandt L. Bohn. "Laser-Supported Detonation Waves in an Obliquely Incident Beam." First International Laser Science Conference, Dallas, TX, November 1985. (Paper)

See R4a

b. With Majors E. Jumper, J. Covick and Larry McKee (all of Air Force Institute of Technology), J. Jackson (Kaman Sciences), and Captain Courtlandt L. Bohn. "Mechanisms for Thermally-Enhanced Target Coupling by Repetetively-Pulsed Lasers Revisited." Fourth Fluid Mechanics, Plasma Diagnostics, and Laser Conference, Atlanta, GA, May 1986. (Paper)

See R4b

7. DURHAM, Richard, Lt Colonel and Assistant Professor

a. With Joseph W. Chamberlain (Rice University). "A Comparative Study of the Early Terrestrial Atmospheres." American Geophysical Union Meeting, Baltimore, MD, May 1986. (Presentation)

We used a radiative-convective model of the atmosphere to demonstrate that Rayleigh scattering would have had a stabilizing effect on the massive carbon dioxide atmospheres theorized for Mars, Earth, and Venus four billion years ago.

b. With Victor M. Martin and Ronald M. Sega (both of University of Colorado). "A Fiber Optic Power Probe." In *Optical Engineering*. (Forthcoming Article)

We describe results obtained in using a fiber optic thermometer to measure microwave power. Using fiber optics minimizes the perturbation of the microwave fields since most of the probes and connections are dielectric.

c. With Joseph W. Chamberlain (Rice University). "A Comparative Study of the Early Terrestrial Atmospheres." In *Icarus*. (Forthcoming Article)

We used a radiative-convective model of the atmosphere to estimate the carbon dioxide content and the effect Rayleigh scattering had on the evolution of the atmospheres of Mars, Earth, and Venus.

d. "A Radiative Transfer Study of the Early Terrestrial Atmospheres." Rice University, Houston, TX, April 1986. (Dissertation)

I use a radiative-convective model of the atmosphere to estimate the levels of carbon dioxide needed in the atmospheres of Mars, Earth, and Venus to maintain the climatic conditions that are thought to have existed on these planets four billion years ago.

e. Work in Progress

"Climate Change: A Methane-Feedback Mechanism." (Research)

8. ENGER, Rolf C., Major and Associate Professor

a. "Integrating the Computer into the Physics Education System--A Proposal." American Association of Physics Teachers Meeting, Atlanta, GA, January 1986. (Presentation)

I propose a curriculum which capitalizes on the strengths of computers and classroom teachers working together as a team. Computers are used whenever speed, accuracy, and frequent repetition are required while classroom instructors contribute the inherent human flexibility.

b. With Major Wayne R. Steinbach. "Methods for Promoting Teaching Excellence." American Association of Physics Teachers Meeting, Atlanta, GA, January 1986. (Presentation)

The Physics Department at the United States Air Force Academy has a constant flux of new faculty members, many of whom find themselves in a full-time teaching position for the first time. For this reason, we have developed a number of programs designed to educate our instructors, improve their teaching skills, and promote teaching excellence.

c. "The Computerized Classroom." *The Instructional Technology Express*, AFRP 50-5, No 8, September 1986. (Article)

I describe my vision of the computerized classroom of the future. This classroom employs computers and teachers working together as a team. The primary purposes of the computerized classroom are to increase opportunities for student interaction, and to capitalize on the inherent flexibility and creativity of teachers.

9. EVANS, David E., Lt Colonel and Tenure Professor

a. With Majors Raymond H. Bloomer and Thomas E. Lascome. "Teaching Modern Physics to Social Science and Humanities Students." American Association of Physics Teachers Meeting, Atlanta, GA, January 1986. (Presentation)

See 83b.

Major Gist debugs a new program written to control a videodisc to be used in classroom instruction

10. GIST, Thomas E., Major and Assistant Professor

a. Work in Progress

"Effectiveness of Computer Controlled Instructor Workstations in the Physics Classroom." (Research)

"Radio Frequency Plasma Reactors." (Dissertation)

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11. HORNE, Jerry D., Captain and Instructor

a. Work in Progress

"Effectiveness of Computer-Controlled Instructor Workstations in the Physics Classroom." (Research)

12. KNIPP, Delores J., Captain and Instructor

a. Work in Progress

"Experimental and Theoretical Studies of Laser-Solid Interaction--Plasma Hydrodynamics, Mechanical Coupling, and Thermal Coupling." (Research)

"Laser Interferometric Studies." (Research)

13. LORENZEN, Gary L., Captain and Assistant Professor

a. Work in Progress

"Effectiveness of Computer-Controlled Instructor Workstations in the Physics Classroom." (Research)

14. McKNIGHT, Darren S., Captain and Instructor

a. "The Analysis of the 1981-53 Fragmentation Event." Strategic Defense Initiative Second Annual Pathways to Space Experimentation Workshop, Orlando, FL, June 1986. (Paper)

We simulate the breakup of the Soviet Kosmos 1275 satellite. Monte Carlo techniques and hypothetical mass-velocity distributions taken from laboratory experiments are used. A variety of simulation cases are discussed and compared with observed debris data.

b. With Robert D. Culp (University of Colorado). "The Simulation of Satellite Breakups." American Institute of Aeronautics and Astronautics/American Astronautical Society Astrodynamics Specialist Conference, Williamsburg, VA, August 1986. (Paper)

We wrote a program to produce fragmentation events whose magnitude, mass distribution, velocity distribution, geometry, and location of breakup may all be controlled. It is shown that simulation aids in the classification of satellite breakups and in providing a more accurate assessment of the debris environment.

c. Work in Progress

"Classification of Satellite Breakups by Average Debris Fragment Lifetime." (Paper)

"Effects of the Strategic Defense Initiative on the Space Debris Environment." (Paper)

"Simulation of On-Orbit Satellite Fragmentations." (Dissertation)

With Nicholas L. Johnson (Teledyne Brown Engineering). *Space Debris: Origins and Consequences*. (Book)

15. McNALLY, James J., Captain and Associate Professor

a. With Ghanim AL-Jumaily and Robert McNeil (both of University of New Mexico). "Ion-Assisted Deposition of Optical Films on Heavy Metal Fluoride Glass Substrates." 17th Annual Boulder Laser Damage Conference, Boulder, CO, October 1985. (Presentation)

We presented results illustrating the advantages of coating heavy metal fluoride glass substrates using ion-assisted deposition.

b. "Properties of Optical Thin Films Deposited Using Ion-Assisted Deposition." 30th Annual Society of Photo-Optical Instrumentation Engineers Symposium, San Diego, CA, August 1986. (Presentation)

I presented results illustrating the effects of ion-assisted deposition on numerous thin film properties.

c. With Ghanim Al-Jumaily and Robert McNeil (both of University of New Mexico). "Effects of Ion-Assisted Deposition on Optical Scatter and Surface Microstructure of Thin Films." *Journal of Vacuum Science and Technology*, A3, 1985, p 651. (Article)

We report measurements of the optical scatter for thin metal films. A reduction in optical scatter was reported for films deposited using ion-assisted deposition. The reduction was dependent on initial substrate roughness, film thickness and deposition rate.

d. With Ghanim Al-Jumaily (University of New Mexico). "Ion-Assisted Deposition of Optical and Protective Coatings for Heavy Metal Fluoride Glass." *Applied Optics*, No. 25, 1986, p 1973. (Article)

We report results of the improved environmental durability of optical coatings deposited on heavy metal flouride glass substrates. The coatings were deposited at low temperature using ion-assisted deposition.

e. With Robert McNeil (University of New Mexico). "Ion-Assisted Deposition of Ta_2O_5 and Al_2O_3 Thin Films." *Journal of Vacuum Science and Technology*, A4, 1986, p 437. (Article)

We report results on the optical properties of Ta_2O_5 and Al_2O_3 thin films deposited using ion-assisted deposition. This technique employs a separate Kaufman ion source to bombard a growing film with oxygen ions during deposition. We obtained larger values of film refractive index and improved spectral stability.

f. With Ghanim Al-Jumaily (University of New Mexico). "Reduction of Optical Scatter in Coated Metal Surfaces." *Journal of Vacuum Science and Technology*, A4, 1986, p 439. (Article)

We report results on reduced optical scatter from thin metal (Cu and Ag) films deposited using various techniques. The reduction was found to correlate with adatom surface mobility.

g. With Ghanim Al-Jumaily and Robert McNeil (both of University of New Mexico), and Jean Bennett (Naval Weapons Center). "Influence of Metal Films on the Optical Scatter and Related Microstructure of Coated Surfaces." *Applied Optics*, No. 25, 1986, p 3631. (Article)

We reported results illustrating the effects of different deposition techniques on thin film microstructure. We showed that films deposited using ion-assisted deposition have a more homogeneous morphology than sputtered or evaporated thin films.

h. With Robert McNeil (University of New Mexico). "Optical Coatings Deposited Using Ion-Assisted Deposition." *Journal of Vacuum Science and Technology*, August 1987. (Forthcoming Article)

We reported results from laser damage tests and fluorine gas exposure tests on single-layer and multi-layer optical coatings. The coatings were fabricated using oxygen-ion-assisted deposition.

i. "Ion-Assisted Deposition of Optical Coatings." University of New Mexico, Albuquerque, NM, May 1986. (Dissertation)

I investiated the effects on the properties of Ta_2O_5, Al_2O_3, SiO_2, and HfO_2 single- and multi-layer optical coatings deposited using ion-assisted deposition.

j. Work in Progress

"Novel Deposition Techniques for Thin Films." (Research)

With Robert McNeil (University of New Mexico). *Ion Beam Deposition*. (Book)

16. McQUADE, Marilyn K., Captain and Assistant Professor

a. Work in Progress

"Effectiveness of Computer-Controlled Instructor Workstations in the Physics Classroom." (Research)

17. MULLINS, Bill W., Captain and Assistant Professor

a. Work in Progress

"Experimental and Theoretical Studies of Laser-Solid Interaction--Plasma Hydrodynamics, Mechanical Coupling, and Thermal Coupling." (Research)

"In-Situ Detection of Micrometer Size Laser Damage Sites by Strehl Intensities." (Research)

"Laser Damage Studies with Gaussian and Sombrero Spatially Profiled Beams." (Research)

"Laser Interferometric Studies." (Research)

18. NEUMANN, David K., Major and Associate Professor

a. With C.H. Muller, III., S.R. Czyzak, and D.J. Stech (all of Frank J. Seiler Research Lab). "Photolytically Initiated Chemical Production of Electronically Excited IF (B)." Air Force Office of Scientific Research, Molecular Dynamics Conference, Hanscom AFB, MA, October 1986 (Presentation)

We reported on recent work in our laboratory relating to our chemical laser development efforts.

b. With G.D. Hager (AF Weapons Lab) et al. "COIL-IV: A Chemical Oxygen Iodine Laser." *Air Force Weapons Laboratory Technical Report*, AFWL-TR-85-64, March 1986. (Report)

We developed and tested the world's highest power short-wavelength laser.

c. With S.R. Czyzak, C.H. Muller, III., and D.J. Stech (all of Frank J. Seiler Research Lab). "IF (B) Chemiluminescence Resulting from Laser Photolysis of Mixtures of 0_3 and C_3F_7I." *Chemical Physics Letters*, August 1986. (Article)

We evaluated the potential of excited oxygen as the chemical "pump" for an IF (B-X) visible chemical laser.

d. With D.J. Stech, C.H. Muller, III., and S.R. Czyzak (all of Frank J. Seiler Research Lab). "Photochemically Pumped I (D'-A') Emission in Mixtures of I_2/C_3F_7I and $I_2/0_3$: Implications for Chemically Initiated, Broadband Optical Pumped I_2 (D'-A') Lasers." *Applied Physics Letters*, September 1986. (Article)

We observed a chemical process which should increase by a factor of twenty the best efficiency of any gas phase optically pumped laser.

e. With N. Pchelkin (AF Weapons Lab). "A Scanning System for Mapping Gas Flow Uniformity in a Laser." U.S. Patent #4,583,001 (Awarded: April 1986). (Patent)

We developed a technique for detecting and quantifying flow inhomogeneities in a four-meter long oxygen-iodine laser.

f. With C.H. Muller, III., S.R. Czyzak, and D.J. Stech. "Chemically Enhanced Ultraviolet Radiation Converter." U.S. Patent (Applied: September 1986). (Patent)

We observed a chemical process which should increase by a factor of twenty the best efficiency of any gas phase optically pumped laser.

g. Work in Progress

"Photolytically Initiated Chemical Production of IF (B)." (Article)

"Kinetics of Metal Vapor Excimers." (Research)

"An Efficient Optically Pumped I_2(D'-A') Laser." (Research)

"New Chemical Production Schemes for IF (B)." (Research)

Captain Varni aligns optical elements used in the diagnostics for the laser/solid interaction research progam

19. POMRENKE, Gernot S., Captain and Assistant Professor

a. With H. Ennen and W. Haydl (both of Fraunhofer Institute fuer Angewandte, Festkoerperphysik, Freiburg, West Germany). "Photoluminescence Optimization and Characteristics of the Rare-Earth Element Erbium Implanted in GaAs, InP, and GaP." *Journal of Applied Physics*, No. 59, 1986, p 601. (Article)

The characteristic 1.54 micron emission from the rare-earth element erbium implanted in GaAs, InP, and GaP was investigated through 10-K photoluminescence essentially as a function of anneal temperatue, time, and method.

b. Work in Progress

"Rare Earth Elements in III-IV compound Semiconductors and Silicon." (Research)

20. STEINBACH, Wayne R., Major and Associate Professor

a. With Major Rolf C. Enger. "Methods for Promoting Teaching Excellence." American Association of Physics Teachers Meeting, Atlanta, GA, January 1986. (Presentation)

See R8b

b. "Neutral Particle Beam Direction Sensing." Air Force Space Technology Center, Kirtland AFB, NM, September 1986. (Report)

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I discussed and compared the various techniques being proposed for neutral particle beam direction sensing. Primary emphasis was placed on laser resonance fluorescence as the most promising technique. I discussed this technique in detail and make suggestions for improved performance.

c. "Neutral Particle Beam Consultation." Air Force Space Technology Center, Kirtland AFB, NM, June-August 1986. (Consultation)

I spent the summer working with the neutral particle beam group at the Air Force Space Tecnology Center. I consulted with program managers dealing in the areas of pointing, tracking, targeting, and developing detectors. I will also be the primary contact for discussions of neutral particle beam direction sensing.

d. Work in Progress

"Test Bank Data and Statistics." (Research)

21. SWANSON, Richard E., Lt Colonel and Tenure Associate Professor

a. Work in Progress

"Effectiveness of Computer-Controlled Instructor Workstations in the Physics Classroom." (Research)

22. VARNI, James G., Captain and Instructor

a. Work in Progress

"On the Cathodoluminescence of Cleartran: A Novel Form of ZnS." (Article)

"On the Hydrodynamics of Laser Induced Vaporization in Vacuum." (Article)

"The Cathodoluminescence of Cleartran: A Novel Form of Polycrystalline ZnS." (Dissertation)

23. WESTBROOK, Christopher, Major and Assistant Professor

a. Work in Progress

"Nuclear Weapons Effects for Survivability Applications." (Consultation)

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CHAPTER S

DEPARTMENT OF POLITICAL SCIENCE

The Department of Political Science encourages research which supports our teaching responsibilities and which adds to the professional preparation of the Department members. Research keeps our courses updated, brings a special sophistication to our courses, and expands the background of Department members through the exchange of ideas within the Department. The Department focuses its research on problems of current importance to the Air Force and the Department of Defense.

1. BURKE, Joseph G., Lt Colonel and Assistant Professor

a. "The Determinants of U.S. Arms Transfer Policy in the Middle East: A Comparative Case Study in U.S. Decision-Making." International Studies Association, Anaheim, CA, March 1986. (Paper and Presentation)

b. "The Determinants of U.S. Arms Transfer Policy in the Middle East: A Comparative Case Study in U.S. Decision-Making." University of Denver, Denver, CO, 1986. (Dissertation)

I compare several key variables commonly assumed to influence U.S. arms sales decisions across seven significant cases, which occurred during the Ford, Carter and Reagan administrations. Conclusions are based on the perceptions of more than fifty former U.S. arms transfer officials.

2. COLE, Donald D., Major and Assistant Professor

a. "Rethinking the Two Presidencies Thesis." International Studies Association, Anaheim, CA, 29 March 1986. (Paper and Presentation)

I tested the "Two Presidencies" thesis by examining appropriations legislation for the period FY60 through FY82. I based my research on a quantitative analysis and conclude that the thesis is not especially helpful in forecasting congressional response to presidential budgetary initiatives. My analysis suggests that congressional response can be better understood in terms of two related themes: environmental response and organizational autonomy.

b. "Arms Control Agreements and Soviet Noncompliance." Office of the Assistant Secretary of Defense for International Security Policy/Strategic Arms Control Policy, Washington, D.C., June-July 1986. (Consultation)

c. "OSD: The Politics of Arms Control." The Alpine Group, USAFA, CO, 15 September 1986. (Presentation)

I surveyed the political/bureucratic landscape surrounding the arms control arena. I offered ten propositions that describe the OSD/ISP outlook on arms control.

3. DREW, S. Nelson, Major and Associate Professor

a. "Moving Democracy to Action: Agenda Setting and Consensus Building in Developing Responses to Perceived Soviet Threats." University of Virginia, Charlottesville, VA, April 1986. (Dissertation)

I analyze case studies on NSC-68, the "missile gap," and the window of vulnerability to compare the roles of the President, Congress, non-government groups, and the mass media in building consensus for increases in defense spending in the absence of an immediate threat of hostile action.

b. "Press Freedom in Yugoslavia: Media and Message Under the Ideology of Self-Management." International Studies Association Southern Regional Conference, University of South Carolina, Columbia, SC, October 1985. (Paper and Presentation)

I examine the tension between the desire for a "free" press and the need for government and party management of information in Yugoslavia's unique situation as a "land between" East and West.

c. "Strategic Doctrine and Domestic Consensus: Setting the Agenda." White Burkett Miller Center for the Study of Public Affairs, University of Virginia, Charlottesville, VA, June 1986. (Presentation and Forthcoming Article)

I analyze the tendency to "oversell" the threat and the response in attempts to build public support for defense initiative. I focus on the relationships among government, mass media, and public opinion.

d. "Two Crises, Not One: The Role of the News Media in the Carter Administrtion's Handling of the Iranian Hostage Crisis." In *Consensus: Issues and Problems*, Michael Joseph and Kenneth W. Thompson, eds., December 1985. (Article)

I conclude that it was the Carter administration's handling of its press relations during the hostage crisis, more than media pressure alone, which contributed most heavily to the elevation of the crisis to "the only concern" of the administration, despite claims to the contrary by administration spokesmen.

e. Work in Progress

"Public Diplomacy and the Berlin Blockade: Soviet Use of Mass Media as an Instrument of Diplomacy during Periods of Confrontation with the West." (Paper and Presentation)

4. DZIEDZIC, Michael J., Major and Associate Professor

a. "Decision Making in Mexican Security Policy." Rocky Mountain Council on Latin American Studies, Estes Park, CO, 4 April 1986. (Paper)

b. "Mexican National Security Policy." National Defense University Conference, Washington D.C., on *The Defense Policies of Nations: A Comparative Study*, Douglas J. Murray and Paul R. Viotti, eds., 27 August 1986. (Presentation and Forthcoming Chapter)

c. "The Essence of Decision in a Hegemonic Regime: The Case of Mexico's Acquisition of a Supersonic Fighter." University of Texas, Austin, TX, 1986. (Dissertation)

5. ELKIN, Jerrold F., Captain and Associate Professor

a. "New Delhi Indian Ocean Policy." International Studies Association, Anaheim, CA, March 1986. (Paper and Presentation)

b. "New Delhi Indian Ocean Policy." *Naval War College Review*. (Forthcoming Article)

c. "India's Defense Policy." National Defense University Conference, Washington D.C., on *The Defense Policies of Nations: A Comparative Study*, Douglas J. Murray and Paul R. Viotti, eds., 27 August 1986. (Presentation and Forthcoming Chapter)

d. "India's Defense Policy." Conference on South Asia, University of Wisconsin, Madison, WI, October 1986. (Paper and Presentation)

e. "Indo-Pakistani Military Balance." *Asian Survey*, May 1986. (Article)

f. With Dr. Henry Dietz (University of Texas at Austin). *The Military as a Vehicle for Social Integration*. (Forthcoming Edited Book)

6. JORDAN, Donald L., Captain and Instructor

a. "The U.S. and Africa: 1985." In *Africa Contemporary Record 1985-86*, Colin Legum, ed. New York: Africana Publishing Co., 1986. (Chapter)

b. With Michael Clough (University of Wisconsin). "Introduction." To *Reassessing the Soviet Challenge in Africa*, Michael Clough, ed., Berkley: Institute of International Studies, 1986. (Chapter)

c. Work in Progress

"Africa--a Bibliographic Essay." In *Defense Policies of Nations*, 2nd edition, Douglas J. Murray and Paul R. Viotti, eds. (Chapter)

7. LARSEN, Jeffrey A., Captain and Instructor

a. "Danish Security Policy in the 1980s: On the Road to Denmarkization?" International Studies Conference, Anaheim, CA, March 1986. (Paper and Presentation)

b. "The Contemporary Political Situation in Spain." California Air National Guard, March AFB, CA, April 1986. Published May 1986 in the final trip report, USAFA-TN-86-1 by the Office of Geography. (Paper and Presentation)

c. "Scandinavian Politics." University of Colorado, Colorado Springs, CO, November 1985. (Presentation)

d. With Captain Jay Lorenzen. "The Political Implications of USAFE Environmental Policy in West Germany." USAFE/DE, Ramstein AB, Germany, June 1986. (Consultation)

e. With Captain Jay Lorenzen. "German Defense Policy." In *Defense Policies of Nations*, 2nd edition, Douglas J. Murray and Paul R. Viotti, eds. (Forthcoming Chapter)

8. LORENZEN, Jay, Captain and Instructor

a. With Captain Jeffrey Larsen. "The Political Implications of USAFE Environmental Policy in West Germany." USAFE/DE, Ramstein AB, Germany, June 1986. (Consultation)

b. With Captain Jeffrey Larsen. "German Defense Policy." In *Defense Policies of Nations*, 2nd edition, Douglas J. Murray and Paul R. Viotti, eds. (Forthcoming Chapter)

9. MURRAY, Douglas J., Colonel, Permanent Professor and Department Head

a. *Canadian Defense Policy*. (Forthcoming Book)

b. "Compartive Interservice Rivalry." (Forthcoming Chapter)

c. Work in Progress

With Lt Colonel Paul R. Viotti. *Defense Policies of Nations*, 2nd edition. (Edited Work)

10. RALLO, Joseph C., Captain and Associate Professor

a. *Defending Europe in the 1990s: The New Divide of High Technology*. International Political Economy series, Frances Pinter, Ltd. (UK) and St. Martin's Press (USA, 1986). (Book)

b. "Italy." In *Defense Policies of Nations*, 2nd edition, Douglas J. Murray and Paul R. Viotti, eds. (Forthcoming Chapter)

c. "Italian Arms Transfers." In *International Affairs*. (Forthcoming Article)

11. ROGERS, Kenneth A., Lt Colonel and Assistant Professor

a. "New Perspectives on Soviet Thinking: The Systems Approach." Texas A&M University, College Station Paper Series, College Station, TX. (Forthcoming Article)

b. "Soviet Defense Policy: A Bibliographic Essay." In *Defense Policies of Nations*, 2nd edition, Douglas J. Murray and Paul R. Viotti, eds. (Forthcoming Chapter)

c. "Soviet Foreign Policy." Presentation to USAFA Assembly Delegates, USAF Academy, CO, 13 February 1986. (Conference)

d. "The Soviet XXVII Party Congress." National Defense Colloquium, USAF Academy, CO, 8 April 1986. (Presentation)

e. Work in Progress

"Soviet MASKIROVKA: Seeing Through the Smokescreen." (Article)

"U.S.-Soviet Scientific and Technological Exchanges: The Environmental Agreement." (Article)

12. VIOTTI, Paul R., Lt Colonel and Tenure Associate Professor

a. *International Relations Theory: Realism, Pluralism, Globalism*. Macmillan Press, 1986. (Book)

b. "Comparative Neutrality in Europe." International Studies Association, Anaheim, CA, 29 March 1986. (Paper and Presentation)

c. "Comparative Neutrality in Europe." American Political Science Association, Washington D.C., August 1986. (Paper and Presentation)

d. "European Security and Arms Control." In forthcoming *American Defense Policy*, 6th edition, Edward Wright and Schuyler Foerster, eds. (Forthcoming Chapter)

e. "U.S.-Soviet Conflict Management." International Studies Association/Section on Military Studies Conference, Cambridge, MA, November 1986. (Paper and Presentation)

f. *Conflict and Arms Control: An Uncertain Agenda*. Boulder: Westview Press, 1986. (Book)

g. Work in Progress

With Colonel Douglas J. Murray. *Defense Policies of Nations*, 2nd edition. (Edited Work)

13. WRIGHT, Edward N., Lt Colonel and Associate Professor

a. "Defense Organization: Prospects for Change." *Reagan Administration Defense Policies: An Assessment*, Southern Methodist University, Dallas, TX, 25-26 April 1986. (Paper and Presentation)

I examine the basis of proposed changes in DoD organization.

b. With Lt Colonel Schuyler Foerster (U.S. Mission, NATO). "The Twin Faces of Defense Policy: International and Domestic." In *American Defense Policy*, 6th edition, Edward Wright and Schuyler Foerster, eds. (Forthcoming Chapter)

We introduce the study of American defense policy.

c. "What is National Security?" Seventeenth Annual Student Symposium, Center for the Study of the Presidency, Washington D.C., 14-16 March 1986. (Presentation)

I survey the range of security issues facing decision-makers into the next decade.

d. Work in Progress

With Lt Colonel Schuyler Foerster (U.S. Mission, NATO). *American Defense Policy*, 6th edition. (Edited Work)

"Congressiongal Influences on SDI." (Consultation)

Presidential Responsibility for Emergency Preparedness: The Reagan Response. (Book)

CHAPTER T

DEPUTATE OF MILITARY INSTRUCTION

Military instruction is conducted by two divisions and one squadron under the Deputy Commandant for Military Instuction. The 50th Airmanship Training Squadron (ATS) presents air and ground instruction in navigation, pilotage and astronomy. The Squadron also operates the Academy Planetarium and the navigation and flight trainers. The Military Studies Division (CWIS) conducts a core curriculum in Professional Military Studies (PMS), which is focused squarely on the profession of arms. PMS courses stress airpower heritage, the art of war, military theory, doctrine and force employment. Our PMS program seeks to provide cadets with a greater understanding of the traditions, tools, operating practices, theoretical principles and challenges of the military profession. Finally, the Military Training Division (CWIT) supervises the cadets' continuous military training, including the Professional Military Training Program, the USAF accredited Survival, Evasion, Resistance and Escape (SERE) School, marksmanship instruction and a multitude of cadet summer programs.

1. ERWIN, Douglas L., (CWIS) Major and Instructor

a. "Eisenhower and NATO: A Study in Grand Strategy." University of Denver, Denver, CO. 1986. (Dissertation)

I analyzed the extent of coherence in national strategy using Eisenhower's policy in NATO as a vehicle.

Major Erwin moderates a debate between Captain Kennedy and Captain Hall over the influence of Russian history and ideology on Soviet military doctrine.

2. GARZA, Mario A , (CWITX) Captain and Honor and Ethics Training Director

a. "Using Microcomputers to Teach Military Theory." 1986 Air Force Conference on Technology in Training and Education, Montgomery, AL, 10-13 March 1986. (Paper and Presentation)

I explained how the Military Studies Division uses microcomputers to reinforce the lessons of military theory cadets learn in the classroom. I described the history of wargaming exercises in our Professional Military Studies (PMS) program, the current use of microcomputers in PMS and the results of using microcomputers to teach military concepts.

3. MARTIN, Jerome V., (CWIS) Major and Deputy Division Chief

a. Work in Progress

"Reforging the Sword: USAF Tactical Air Forces, Air Power Doctrine, and National Security Policy, 1950-1960." (Dissertation)

4. O'CONNELL, William T., (CWITT) Major and Curriculum Chief

a. "The Academy Training Philosophy for the Subordinate Leader: A Study of Assertive Followership Skills." United States Air Force Academy, CO, August 1986. (Book)

I define an assertive follower and illustrate the contributions such a person can make to the unit. I also explain how an assertive follower obtains expectation to start a task, obtains feedback on his or her performance, effectively deals with rewards and punishments, and communicates up the chain of command.

5. SCULLY, James E., (CWITT) Major and Branch Chief

a. "Leadership and Management Workshop." Precommissioning/Initial Education Memorandum of Understanding (PIEMU) Workshop, USAF Officer Training School, Lackland AFB, TX, 12-15 May 1986. (Presentation)

I briefed the conferees on how the USAF Academy, as an institution, achieves the goals and competencies of the PIEMU. Specifically, I discussed how we teach leadership and management through Professional Military Training (PMT) programs like the Positive Motivation Model, Assertive Followership Training and the Commanders' Leadership Enrichment Seminars (CLES). The conferees later discussed PIEMU goals and curriculum topics.

6. TITUS, James, (CWIS) Lt Colonel and Associate Professor

a. "Current Joint Doctrinal Issues."Squadron Officers School, Maxwell AFB, AL, 29 April 1986. (Presentation)

I discussed the current Air Force position on selected joint doctrinal issues. These issues included the Air Land Battle doctrine, Air Force support of maritime operations, and command arrangements at U.S. Space Command.

CHAPTER U

FRANK J. SEILER RESEARCH LABORATORY

The Frank J. Seiler Research Laboratory (FJSRL) is an Air Force Systems Command (AFSC) organization, and is part of the Air Force Office of Scientific Research (AFOSR). The Laboratory was established as a tenant organization at the Academy in 1962. Our two major directorates--Chemistry and Lasers/Aerospace Mechanics--support six main research projects:

1. electrochemistry--ways to make more powerful batteries;
2. energetic materials--how to make more stable and powerful propellants and explosives;
3. laser research--evaluation of short wavelength candidates;
4. laser effects--laser damage to optical components and laser target interactions;
5. laser guidance systems-how to improve laser gyroscopes; and
6. aeromechanics--unsteady airflow applied in ways to obtain greater lift from an airfoil.

We use both our permanently assigned personnel and specialists from other organizations in our research and teaching. In addition to the members of the Faculty who help, we have a very successful Research Associate program which brings in professors from civilian colleges, scientists from civilian laboratories and institutions, Air Force Reserve personnel, and selected graduating cadets who are awaiting pilot training.

1. BOON, Jeffrey L., Graduate Student and Research Technician

a. With Lawrence Koons (Tuskegee Institute) and Dr. John S. Wilkes. "Bromine Electrochemistry in Chloroaluminate and Bromoaluminate Molten Salts." Presented at the EUCHEM Conference on Molten Salts, Geiranger, Norway, 21-26 August 1986. (Presentation)

See U41a

b. With Lt Colonel Joseph A. Levisky, John L. Pflug, and Dr. John S. Wilkes. "Friedel-Crafts Reactions in Ambient Temperature Molten Salts." *Journal of Organic Chemistry*, 51 (1986): 480-483. (Article)

See U41f

c. With Lt Colonel Joseph A. Levisky, Dr. G. Fredric Reynolds, and Dr. John S. Wilkes. "Reaction of Chlorine with Ambient Temperature Chloroaluminate Molten Salts." Presented at the Fifth International Symposium on Molten Salts, 168th Meeting of the Electrochemical Society, Las Vegas, NV, 15 October 1985. (Presentation)

See U41k

2. BOSCO, Salvatore R., Major and Research Associate

a. With Dr. William R. Carper and Dr. James J.P. Stewart. "Hydrogen Bonding Studies of 2, 4, 6-Trinitrotoluene." *Spectrochimica Acta*, 42A, No. 4 (1986): 461-466. (Article)

See U4b

b. With Dr. William R. Carper and Dr. James J.P. Stewart. "Vibrational Spectra of 2, 4, 6-Trinitrotoluene and its Isotopically Substituted Analogues." *Spectrochimica Acta*, 42A, No. 1 (1986): 13-21. (Article)

Infrared spectra of 2, 4, 6-trinitrotoluene and four of its isotopic analogues (^2H and ^{15}N) have been recorded in the solid state. MNDO-based calculations have been used to predict the fundamental vibrational frequencies of each compound in addition to toluene and nitrobenzene. We obtained a good fit between observed and calculated frequencies.

3. BROST, George A., Doctor and National Research Council Research Associate

a. With Dr. William Boyle (Kaman Sciences), Major Terrence F. Deaton, Dr. Bruce W. Duvall (Kaman Sciences), Major John C. Souders, and Dr. John R. Tinsley (Kaman Sciences). "Convenient Measurement of Small Impulses." *Review of Scientific Instruments*, Vol. 57(1), January 1986. (Article)

We describe a convenient method which has been used for the measurement of small impulses (1 to 20 dyne sec). An inductive displacement gauge was used to monitor displacement of a ballistic pendulum.

b. With Major Terrence F. Deaton, Dr. Bruce W. Duvall (Kaman Sciences), Captain Frank Eng, Major John C. Souders, Captain Mark D. Stephen, and Dr. John R. Tinsley (Kaman Sciences). "Mechanical Coupling of an Iodine Laser Pulse Incident Obliquely on Aluminum." *Southwest Conference on Optics*, S. Stotlar, Ed., SPIE 5400 (1985): 290-294. (Article)

4. CARPER, William R., Doctor and National Research Council Research Associate

a. With Larry P. Davis (Bolling AFB), R. Cameron Dorey (Medical College of Virginia), and Captain Jon T. Swanson. "An EPR Study of the Thermal Decomposition of Molten 2,4,6-Trinitrotoluene and its Isotopic Analogs." *Magnetic Resonance in Chemistry*, Vol. 24 (1986): 762-767. (Article)

See U38c

b. With Major Salvatore R. Bosco and Dr. James J.P. Stewart. "Hydrogen Bonding Studies of 2,4,6-Trinitrotoluene." *Spectochimica Acta*, 42A, No. 4 (1986): 461-466. (Article)

Infrared and NMR spectra of 2, 4, 6-trinitrotoluene have been recorded in various solvents. Evidence is obtained for both intra- and inter-molecular hydrogen bonding. AM1 calculations are used to predict the fundamental vibrational frequencies of 2,4,6-trinitrotoluene.

c. With Major Salvatore R. Bosco and Dr. James J.P. Stewart. "Vibrational Spectra of 2,4,6-Trinitrotoluene and its Isotopically Substituted Analogues." *Spectrochimica Acta*, 42A, No. 1 (1986): 13-21. (Article)

See U2b

5. CARPIO, Ronald A., Captain and Research Chemist

a. With Roger Bunting (Illinois State University), Lowell A. King, and Lt Colonel Armand A Fannin, Jr. "Potientometric and Vapor Pressure Measurements of Acidic LiCl/$AlCl_4$- Melts." Presented at the Fifth International Symposium on Molten Salts, 168th Meeting of the Electrochemical Society, Las Vegas, NV, 15 October 1985. (Presentation)

Vapor pressures of LiCl-$AlCl_3$ melts were measured in the temperature range 170-270°C and the $AlCl_3$ mole fraction range 0.525-0.65. The value of the dissociation constant for the reaction, $2AlCl_4^- \rightleftharpoons Al_2Cl_7^- + Cl^-$, at 175°C was determined to be 3×10^{-5}.

6. COOK, Richard J., Major and Director, Lasers and Aerospace Mechanics Directorate

a. With H. Jeffrey Kimble (University of Texas) and Ann L. Wells (Wright-Patterson AFB). "Intermittent Atomic Fluorescence." *Physical Review A*, 34, October 1986: 3190. (Article)

In a single-atom double-resonance experiment involving a strong and weak transition, quantum jumps on the weak transition cause the resonance fluorescence of the strong transition to turn on and off randomly in time when observed over intervals long compared to the lifetime of the strong transition but short compared to that of the weak transition. Here we present a theory of this intermittent atomic fluorescence for the case of coherent excitation.

b. "Telegraphic Atomic Fluorescence." Presented at the Conference on Atoms, Molecules and Methods, Los Alamos National Laboratory, Los Alamos, NM, 10 July 1986 and also presented at the Lawrence Livermore National Laboratory, Livermore, CA, 15 September 1986. (Presentation)

In a single-atom double-resonance experiment involving a strong and a weak transition, quantum jumps on the weak transition cause the fluorescence of the strong transition to turn on and off abruptly. Thus quantum jumps on the weak transition can be directly monitored by observation at the random telegraph signal radiated by the strong transition.

7. CZYZAK, Stanley R., Major and Research Associate

a. With Dr. Cliff H. Muller, III., Major David R. Neumann, and Captain Daniel J. Stech. "IF($B^3\pi$) Chemiluminescence Resulting from Laser Photolysis of Mixtures of O_3 and C_3F_7I." *Chemical Physics Letters*, August 1986. (Article)

We report the first observation of photochemically initiated $I_2(D'\text{-}A')$ emission at 342 nm. Mixtures of I_2 and C_3F_7I or I_2 and O_3 were excited by a KrF laser at 248 nm photodissociating the C_3F_7I or O_3.

8. DEATON, Terrence F., Major and Research Associate

a. With Dr. William Boyle (Kaman Sciences), Dr. George A. Brost, Dr. Bruce W. Duvall (Kaman Sciences), Major John C. Souders, and Dr. John R. Tinsley (Kaman Sciences). "Convenient Measurement of Small Impulses." *Review of Scientific Instruments*, Vol 57(1), January 1986. (Article)

See U3a

b. With Lieutenant Ya-Jen Chang, Lieutenant John F. Hilbing, Captain Billy W. Mullins, Dr. Andrew B. Romberger (Pennsylvania State University), Captain Alan A. Schaffer, Lt Colonel Kenneth E. Siegenthaler. "Laser Damage Studies of Several Acrylic Polymers." Presented at the 17th Annual Laser Damage Symposium, Boulder, CO, 29 October 1985. (Presentation)

See U28a

c. With Dr. George A. Brost, Dr. Bruce W. Duvall (Kaman Sciences), Captain Frank Eng, Major John C. Souders, Captain Mark D. Stephen, and Dr. John R. Tinsley (Kaman Sciences). "Mechanical Coupling of an Iodine Laser Pulse Incident Obliquely on Aluminum." *Southwest Conference on Optics*, S. Stotlar, Ed., SPIE 5400 (1985): 290-294. (Article)

9. DONNERT, Hermann J., Doctor and National Research Council Research Associate

a. With Mark A. Ferrel, Gary W. Scronce, and Kevin A. Stroh (all of University of Kansas). "Effects of Electron Irradiation on the Optical Properties of Laser Mirrors."Presented at the 17th Annual Symposium on Optical Materials for High Power Lasers, Boulder, CO, 30 October 1985. (Presentation)

Exposure of dieletric laser mirrors to nuclear radiation affects the optical characteristics of laser mirrors. Optical transmission and reflectivity of coatings and substrates are altered with concomitant changes of laser-damage thresholds. After appropriate characterization of optical properties of pristine mirror samples, transient and long-term changes of reflectivity were observed during and subsequent to bombardment with intense (up to about 20 kA/m^2), short-duration (up to about 1 ms) pulses of energetic (nominally in the energy range from 1 MeV to 20 MeV) electrons.

10. DYMEK, Chester J., Lt Colonel and Senior Scientist

a. With Dr. G. Fredric Reynolds. "Galvanic Cells Using Room Temperature Molten Salts." Presented at the Fifth International Symposium on Molten Salts. 168th Meeting of the Electrochemical Society, Las Vegas, NV, 15 October 1985. (Presentation)

Two galvanic cells were tested using as electrolytes room temperatue molten salts formed by mixing $AlCl_3$ with l-methyl-3-ethylimidazolium chloride (MEICl). Zn and Cd, each with basic melt (containing Cl^- and $AlCl_4^-$) were the anodes. Br_2 dissolved in basic melt with a reticulated vitreous carbon current collector was the cathode in each case. MEI^+-selective NAFION c as a separator. The Zn electrode was found to be irreversible, while the Cd/Br_2 cell appears to be reversible with an open circuit voltage of 2.0 V, an extended temperature range of operation, and potential for high specific energy.

11. FANNIN, Armand A., Jr., Lt Colonel and Senior Scientist

a. With Major Charles L. Hussey, Dr. Towner B. Scheffler, and Dr. John S. Wilkes. "Chloroaluminate Equilibria in the Aluminum Chloride l-Methyl-3-Ethylimidazolium Chloride Ionic Liquid." *Journal of the Electrochemical Society*, 133 (1986): 1389. (Article)

See U41c

b. "PHD--A Package Concept for Small Scientific Databases." Presented to the Eighth Rocky Mountain Regional ACS Meeting, Denver, CO, 9 June 1985. (Presentation)

PHD (Program for Handling Data) is a database management system developed to support the collection of physical measurement data. PHD consists of a group of modules written in BASIC which allows the manipulation of experimental data both mathematically and visually. It provides aids such as listings and graphics, as well as the facility to add, delete, sort, merge, rearrange, retrieve, and perform multivariate non-linear regression on collections of data. The system is designed to also allow users to add their own manipul. ion.

c. With Roger Bunting (Illinois State University), Captain Ronald A. Carpio, and Lowell A. King. "Potientometric and Vapor Pressure Measurements of Acidic $LiCl/AlCl_4$- Melts." Presented at the Fifth International Symposium on Molten Salts, 168th Meeting of the Electrochemical Society, Las Vegas, NV, 15 October 1985. (Presentation)

See U5a

d. With Dr. John S. Wilkes. "Temperature-Composition Surfaces for Physical Properties of Aluminum Chloride--l-Methyl-3-Ethylimidazolium Chloride Room Temperature Molten Salts." FJSRL-TR-86-0004, July 1986. (Technical Report)

See U41m

12. FERREL, Mark A., Student and Research Assistant

a. With Dr. Hermann J. Donnert, Gary W. Scronce, and Kevin A. Stroh (all of University of Kansas). "Effects of Electron Irradiation on the Optical Properites of Laser Mirrors." Presented at the 17th Annual Symposium on Optical Materials for High Power Lasers, Boulder, CO, 30 October 1985. (Presentation)

See U9a

13. HEIMER, Norman, Doctor and University Resident Research Professor (URRP)

a. With Dr. James J.P. Stewart and Captain Jon T. Swanson. "MOPAC--A General Molecular Orbital Package, Version 3.1, IBM-PC Version." *Quantum Chemistry Program Exchange*, No. QCMP-019, 6 (1986): 99. (Article)

See U36l

b. With Dr. James J.P. Stewart and Captain Jon T. Swanson. "MOPAC IBM-PC XT Manual (First Edition): A General Molecular Orbital Package." FJSRL-TR-86-0006, June 1986. (Technical Report)

See U36n

c. "Reactions of Organometallics with Xenon Difluoride." Presented at the Organic Chemists Meeting, Colorado Springs, CO, 3 February 1986. (Presentation)

The reaction of xenon difluoride with Grignard reagents and diphenyl magnesium has been examined as a possible route to specifically fluorinated products. I discussed the methods used in the study and the results. The reaction does not appear to be an efficient route to fluorinated products. The reaction of xenon difluoride with diphenyl magnesium can be explained by an initial reaction in which diphenyl xenon is formed and the isolated products are formed by decompesition of the intermediate.

14. HELIN, Henry E., Captain and Research Associate

a. With Dr. Marvin W. Luttges and Dr. Michael C. Robinson. "Visualization of Dynamic Stall Controlled by Large Amplitude Integrated Pitching Motions." Presented to the AIAA Atmospheric Flight Mechanics Conference, Williamsburg, VA, 18-20 August 1986. (Presentation)

Experimental flow visualization studies of airfoil dynamic stall induced by various combinations of interrupted pitching motions were conducted to further examine the aerodynamic control of unsteady separated flows.

b. With Lt Colonel Fred T. Gilliam (DFAN), Dr. Michael C. Robinson, Major John H. Russell, and Major John M. Walker. "Visualization of Three-Dimensional Forced Unsteady Separated Flow." Presented Paper No. 86-1066 to the AIAA/ASME Fourth Fluid Mechanics, Plasma Dynamics and Lasers Conference, Atlanta, GA, 13 May 1986. (Article)

See U27b

15. HUSSEY, Charles L., Major and Research Associate

a. With Lt Colonel Armand A. Fannin, Jr., Dr. Towner B. Scheffler, and Dr. John S. Wilkes. "Chloroaluminate Equilibria in the Aluminum Choloride l-Methyl-3-Ethylimidazolium Chloride Ionic Liquid." *Journal of the Electrochemical Society*, 133 (1986): 1389. (Article)

See U41c

16. KING, Lowell A., Doctor and Research Associate

a. With Roger Bunting (Illinois State University), Captain Ronald A. Carpio, and Lt Colonel Armand A Fannin, Jr. "Potientometric and Vapor Pressure Measurements of Acidic LiCl/$AlCl_4$- Melts." Presented at the Fifth International Symposium on Molten Salts, 168th Meeting of the Electrochemical Society, Las Vegas, NV, 15 October 1985. (Presentation)

See U5a

17. KLEI, Herbert E., Captain and Research Associate

a. With Dr. James J.P. Stewart. "Calculations of Polymer Elastic Modulus by Semi-Empirical Methods." Presented at the International Symposium on Approaches to Property Limits in Polymers, Princeton, NJ, 11 August 1986. (Presentation)

Using semi empirical methods, the elastic modulus of several high polymers was calculated. These results compare favorably with experiments.

b. With Dr. G. Fredric Reynolds, Dr. Towner B. Scheffler, and Dr. John S. Wilkes. "Preliminary Studies on New Molten Salt Systems Based on l-Methyl-3-Ethylimidazolium Chloride and Metal Chloride Salts other than Aluminum Chloride." Presented at the Fifth International Symposium on Molten Salts, 168th Meeting of the Electrochemical Society, Las Vegas, NV, 15 October 1985. (Presentation)

See U41j

c. "Theoretical Calculation of Elastic Moduli Results." Presented at the High Polymer Conference, Dayton, OH, 15 November 1985. (Presentation)

We have recently developed a method for the calculation of polymer elastic moduli by semi-empirical chemical calculation. Initial results indicate the method to be very promising for predicting some physical properties of polymers.

d. With Wade W. Adams, R.K. Eby, P.J. Lenhert (all of Wright-Patterson AFB), and Dr. James J.P. Stewart. "The Ultimate Modulus of Rigid Rod Polymer Fibers." Presented at the International Symposium on Approaches to Property Limits in Polymers, Princeton, NJ, 11 August 1986. (Presentation)

The experimental and theoretical estimates for the ultimate modulus of such polymers as poly (p-phenylene benzobisthiazole were presented and discussed.

18. KOONS, Lawrence, Doctor and Summer Faculty Research Professor

a. With Jeffrey L. Boon and Dr. John S. Wilkes. "Bromine Electrochemistry in Chloroaluminate and Bromoaluminate Molten Salts." Presented at the EUCHEM Conference on Molten Salts, Geiranger, Norway, 21-26 August 1986. (Presentation)

See U41a

19. KRONCKE, G. Thomas, Major and Research Associate

a. With Major James R. Rotge, Bill J. Simmons, and Captain Daniel J. Stech. "Optical Rotation Sensors--Final Report." FJSRL-TR-86-0002, May 1986. (Technical Report)

See U29d

20. LANDER, Stephen W., Jr., Major and Director, Chemical Sciences Directorate

a. With Dr. Phillip R. DeShong and Dr. Joseph M. Leginus (both of Pennsylvania State University). "Steroselective Approach to the Synthesis of Allylic and Homoallylic Amines." *Journal of Organic Chemistry*, 51 (1986): 574-576. (Article)

Nitrones undergo (3 + 2) dipolar cycloaddition with vinyl- and allyisilane derivatives to produce substituted isoxazolidines which are versatile intermediates for the preparation of allylic and homoallylic amines. During olefination, the alkene geometry can be controlled by the appropriate selection of reaction conditions.

b. "Use of Nitrone Cycloadditions with Vinyl Silane in the Synthesis of Unsaturated Amines and 1,3-Aminoaldehydes." Presented at the Society of Organic Chemistry Meeting, Colorado Springs, CO, 10 May 1986. (Presentation)

Nitrones undergo facile cycloaddition with unsaturated silanes to produce isoxazolidixes. Depending on the starting materials these isoxazolidines can be transformed into other useful compounds. 4-Silylisoxazolidines can be made stereoselectively into allylic amines, while 5-Silylisoxazolidines can fragmented into 1,3-aminoaldehydes.

21. LEVISKY, Joseph A., Lt Colonel and Research Associate

a. With Jeffrey L. Boon, John L. Pflug, and Dr. John S. Wilkes. "Friedel-Crafts Reactions in Ambient Temperature Molten Salts." *Journal of Organic Chemistry*, 51 (1986): 480-483. (Article)

See U41f

b. With Jeffrey L. Boon, Dr. G. Fredric Reynolds, and Dr. John S. Wilkes. "Reaction of Chlorine with Ambient Temperature Chloroaluminate Molten Salts." Presented at the Fifth International Symposium on Molten Salts, 168th Meeting of the Electrochemical Society, Las Vegas, NV, 15 October 1985. (Presentation)

See U41k

22. LUTTGES, Marvin W., Doctor and University Research Associate

a. With Jeff Ashworth (University of Colorado). "Comparisons in Three-Dimensionality in the Unsteady Flows Elicited by Straight and Swept Wings." Presented to the AIAA Atmospheric Flight Mechanics Conference, Williamsburg, VA, 18-20 August 1986. (Presentation)

We investigated the three-dimensional, unsteady flow field about a sinusoidally pitching forward swept wing, straight wing and aft swept wing. Flow visualization was accomplished using stroboscopic photography and a smoke wire technique at seven unique span locations across each wing.

b. With Captain Henry E. Helin and Dr. Michael C. Robinson. "Visualization of Dynamic Stall Controlled by Large Amplitude Integrated Pitching Motions." Presented to the AIAA Atmospheric Flight Mechanics Conference, Williamsburg, VA. 18-20 August 1986. (Presentation)

See U14a

c. With Jeff Ashworth and Mark Waltrip (both of University of Colorado). "Three Dimensional Unsteady Flow Fields Elicited by a Pitching Forward Swept Wing." Presented at the AIAA/ASME Fourth Fluid Mechanics, Plasma Dynamics and Lasers Conference, Atlanta, GA, 13 May 1986. (Presentation)

We analyzed the unsteady three-dimensional flow field about an oscillating forward swept wing using photographic flow visualization techniques. Flow field characteristics were examined and compared for different K values, mean angles of attack, and oscillation amplitudes across a sequence of spanwise locations.

23. MULLER, Clifford H., III., Doctor and National Research Council Research Associate

a. With Major Stanley R. Czyzak, Major David R. Neumann, and Captain Daniel J. Stech. "IF($B^3\pi$) Chemiluminescence Resulting from Laser Photolysis of Mixtures of O_3 and C_3F_7I." *Chemical Physics Letters*, August 1986. (Article)

See U7a

24. PFLUG, John L., Analytical Chemist

a. With Jeffrey L. Boon, Lt Colonel Joseph A. Levisky, and Dr. John S. Wilkes. "Friedel-Crafts Reactions in Ambient Temperture Molten Salts." *Journal of Organic Chemistry*, 51 (1986): 480-483. (Article)

See U41f

25. PIERSMA, Bernard, Doctor and Summer Faculty Research Professor

a. With Dr. John S. Wilkes. "Electrochemistry of Ferrocene in l-Methyl-3-Ethylimidazolium Chloride/Aluminum Chloride Room Temperature Melts." FJSRL-TR-86-0005, August 1986. (Technical Report)

See U41d

b. With Dr. John S. Wilkes. "Electrochemistry of Sulfur Na_2S, S_2, S_2Cl_2 in l-Methyl-3-Ethylimidazolium Chloride--Aluminum Chloride Melts." FJSRL-TR-86-0009, August 1986. (Technical Report)

See U41e

26. REYNOLDS, G. Fredric, Doctor and National Research Council Research Associate

a. With Lt Colonel Chester J. Dymek, Jr. "Galvanic Cells Using Room Temperature Molten Salts." Presented at the Fifth International Symposium on Molten Salts, 168th Meeting of the Electrochemical Society, Las Vegas, NV, 15 October 1985. (Presentation)

See U10a

b. With Captain Herbert E. Klei, Dr. Towner B. Scheffler, and Dr. John S. Wilkes. "Preliminary Studies on New Molten Salt Systems Based on 1-Methyl-3-Ethylimidazolium Chloride and Metal Chloride Salts other than Aluminum Chloride." Presented at the Fifth International Symposium on Molten Salts, 168th Meeting of the Electrochemical Society, Las Vegas, NV, 15 October 1985. (Presentation)

See U41j

c. With Jeffrey L. Boon, Lt Colonel Joseph A. Levisky, and Dr. John S. Wilkes. "Reaction of Chlorine with Ambient Temperature Chloroaluminate Molten Salts." Presented at the Fifth International Symposium on Molten Salts, 168th Meeting of the Electrochemical Society, Las Vegas, NV, 15 October 1985. (Presentation)

See U41k

27. ROBINSON, Michael C., Doctor and University Resident Research Professor

a. With Captain Henry E. Helin and Dr. Marvin W. Luttges. "Visualization of Dynamic Stall Controlled by Large Amplitude Integrated Pitching Motions." Presented to the AIAA Atmospheric Flight Mechanics Conference, Williamsburg, VA, 18-20 August 1986. (Presentation)

See U14a

b. With Lt Colonel Fred T. Gilliam (DFAN), Captain Henry E. Helin, Major John H. Russell, and Major John M. Walker. "Visualization of Three-Dimensional Forced Unsteady Separated Flow." Paper No. 86-1066 to the AIAA/ASME Fourth Fluid Mechanics, Plasma Dynamics and Lasers Conference, Atlanta, GA, 13 May 1986. (Article)

Three-dimensional unsteady flow separation was visualized for a straight NACA 0015 wing section pitching at constant rates from 0° to 60° angle of attack. Leading and trailing edge vortices generated were compared with similar two-dimensional phenomena. Vortex-vortex interactions between separation induced and wing-tip vortices were examined.

c. With Lt Colonel Fred T. Gilliam (DFAN), Major John M. Walker, and Captain John B. Wissler (DFAN). "Visualization of Unsteady Separated Flow about a Pitching Delta Wing." Abstract submitted to the AIAA 25th Aerospace Sciences Meeting, Reno, NV, 12-15 January 1987. (Presentation)

See U40e

28. ROMBERGER, Andrew B., Doctor and University Resident Research Professor

a. With Lieutenant Ya-Jen Chang, Major Terrence F. Deaton, Lieutenant John F. Hilbing, Captain Billy W. Mullins, Captain Alan A. Schaffer, Lt Colonel Kenneth E. Siegenthaler. "Laser Damage Studies of Several Acrylic Polymers." Presented at the 17th Annual Laser Damage Symposium, Boulder, CO, 29 October 1985 (Presentation)

The bulk laser damage resistance of several acrylic copolymers and of pure poly(ethyl)methacrylate (PEMA) was investigated with a 1.06 mm wavelength pulsed Nd:YAG laser having a pulse length of 8+2 ns and e^{-2} radius spot size of 30 + 0.7 mm. These materials were synthesized in the bulk after extensive filtration or distillation to remove absorbing dust particles. A correlation is made between the damage thresholds and the number of scattering centers per volume observed in a HeNe beam. The HeNe laser beam scattering in the sample was used as an indicator of the impurity content of the sample. In the course of this experiment a spatial filter was installed in order to make the focused YAG laser beam more nearly Gaussian. Comparison of results obtained from the filtered beam and the unfiltered beam (which is mathematically described as a sombrero function) indicated that previous characterization of the non-Gaussian beam provided an incorrectly low damage threshold value.

29. ROTGE, James R., Major and Research Associate

a. "Advanced Laser-Based Inertial Instrument Development." FJSRL-TR-86-0001, March 1986. (Technical Report)

Active laser gyroscopes suffer from a lock-in phenomenon, a result of backscatter from the cavity optical elements, which limit their performance in the regime of near-zero rotation. The flip-flop gyroscope proposed and initially investigated under this effort shows potential for minimizing or avoiding this lock-in effect. The need for a high accuracy, inexpensive and reliable clock, suitable for avionics applications was the motivation for the laser clock proposed and studied during the course of this effort. Both devices require and deserve further investigation to properly demonstrate their utility.

b. With Lt Colonel Daniel J. Biezad (Air Force Institute of Technology) and Captain Mark A. Lorenz (DFAS). "A Laser Feedback Control Design for Passive Ring Laser Gyros for Use in High Sensitivity Applications." Presented at the AIAA Guidance and Control Conference, Williamsburg, VA, 18-20 August 1986. (Presentation)

The special purity of a HeNe laser can be significantly enhanced by locking the laser's frequency to a resonance of an optical cavity. This frequency stabilization is achieved by electronic feedback and sensor control of the laser's cavity length and discharge current. The frequency locking technique described in this paper may be applied to Passive Resonant Ring Laser Gyroscopes (PRRLG) and towards improving frequency standards and length measurements. When this technique was applied to a 169 cm^2 PRRLG, we obtained a random error of 0.0078 Earth Rate Units (ERU). Extrapolation of this performance to proposed large PRRLGs indicates the desired sensitivities for precision rate sensor testing, geophysical investigations, and relativity experiments are attainable.

c. "Laser Mirror Profilometry by High-Q Interferometry." Presented at the 17th Annual Laser Damage Symposium, Boulder, CO, 29 October 1985. (Presentation)

I describe a novel interferometric technique, which exploits the relationship between an optical resonator's length and resonant frequency. This concept has potential for measuring length variations of an order of $<<1$Å. This paper briefly describes the concept, the experiment performed to demonstrate the concept, and the experimental results. Results obtained indicate a repeatability in the measured data to ~5Å rms.

d. With Major G. Thomas Kroncke, Bill J. Simmons, and Captain Daniel J. Stech. "Optical Rotation Sensors--Final Report." FJSRL-TR-86-0002, May 1986. (Technical Report)

Research efforts were concentrated on passive ring laser rotation sensor technology. This report documents the many accomplishments leading to, and the status of the large passive resonant ring laser gyro (PRRLG) at the date of the PRRLG stop order, November 1985.

30. SCHEFFLER, Towner B., Doctor and National Research Council Research Associate

a. With Lt Colonel Armand A. Fannin, Jr., Major Charles L. Hussey, and Dr. John S. Wilkes. "Chloroaluminate Equipibria in the Aluminum Chloride 1-Methyl-3-Ethylimidazolium Chloride Ionic Liquid." *Journal of the Electrochemical Society*, 133 (1986): 1389. (Article)

See U41c

b. With Captain Herbert E. Klei, Dr. G. Fredric Reynolds, and Dr. John S. Wilkes. "Preliminary Studies on New Molten Salt Systems Based on l-Methyl-3-Ethylimidazolium Chloride and Metal Chloride Salts other than Aluminum Chloride." Presented at the Fifth International Symposium on Molten Salts, 168th Meeting of the Electrochemical Society, Las Vegas, NV, 15 October 1985. (Presentation)

See U41j

31. SCRONCE, Gary W., Student and Research Assistant (GSSSP)

a. With Dr. Hermann J. Donnert, Mark A. Ferrel, and Kevin A Stroh (all of University of Kansas). "Effects of Electron Irradiation on the Optical Properties of Laser Mirrors." Presented at the 17th Annual Symposium on Optical Materials for High Power Lasers, Boulder, CO, 30 October 1985. (Presentation)

See U9a

32. SIEGENTHALER, Kenneth E., Lt Colonel and Chief Scientist

a. With Lieutenant Ya-Jen Chang, Major Terrence F. Deaton, Lieutenant John F. Hilbing, Captain Billy W. Mullins, Dr. Andrew B. Romberger (Pennsylvania State University), Captain Alan A. Schaffer. "Laser Damage Studies of Several Acrylic Polymers." Presented at the 17th Annual Laser Damage Symposium, Boulder, CO, 29 October 1985. (Presentation)

See U28a

33. SIMMONS, Bill J., Research Associate

a. "Iso-Pad Users Manual." FJSRL-TM-86-0001, June 1986. (Technical Memorandum)

The Iso-Pad is included in the USAF Academy's Guidance and Control Laboratory, to provide a low-vibration environment for testing of inertial navigation components and systems. Included in this TM are brief descriptions of the facility, Iso-Pad construction, controls systems, and performance.

b. With Major G. Thomas Kroncke, Major James R. Rotge, and Captain Daniel J. Stech. "Optical Rotation Sensors--Final Report." FJSRL-TR-86-0002, May 1986. (Technical Report)

See U29d

34. SIURU, William D., Jr., Doctor and Summer Faculty Research Professor

a. With Dr. David C. Chou (University of New Mexico) and Major John M. Walker. "Aerodynamic Parameters for a Pitching Airfoil." Abstract submitted to the AIAA 25th Aerospace Sciences Meeting, Reno, NV, 12-15 January 1987. (Presentation)

See U40a

35. STECH, David J., Captain and Research Assoicate

a. With Major Stanley R. Czyzak, Dr. Cliff H. Muller, III., and Major David R. Neumann. "IF($B^3\pi$) Chemiluminescence Resulting from Laser Photolysis of Mixtures of O_3 and C_3F_7I." *Chemical Physics Letters*, August 1986. (Article)

See U7a

b. With Lt Colonel Daniel J. Biezad (Air Force Institute of Technology). "Optical Feedback Stabilization of Laser Diodes for Rotation Sensing Applications." Presented to the SPIE Conference, Cambridge, MA, 22-24 September 1986. (Presentation)

Reduced cost, greater reliability, and compatability with integrated optics are some of the advantages gained by incorporating semiconductor lasers into the design of passice resonant ring laser gyroscopes (PRRLG). This research details the modification of a laser diode to obtain a stable, single mode, narrow spectral output using an optical feedback configuration compatible with the input optics to a PRRLG. Spectral narrowing and modal dynamics of the external coupled cavity laser were measured. By temperature stabilization and optical feedback a free-running linewidth of 60 MHz was reduced to approximately 13 MHz or less and was maintained in a single mode for over twenty minutes.

c. With Major G. Thomas Kroncke, Major James R. Rotge, and Bill J. Simmons. "Optical Rotation Sensors--Final Report." FJSRL-TR-86-0002, May 1986. (Technical Report)

See U29d

36. STEWART, James J.P., Doctor and National Research Council Research Associate

a. "AMPAC: The Austin Equivalent of MOPAC 3.0." *Quantum Chemistry Program Exchange*, No. 506 (1986). (Article)

I described a general purpose semi-empirical quantum chemical program for calculation of heats of formation of molecules including chromium compounds.

b. "Calculations of Elastic Moduli by Semi-Empirical Methods." Presented at the Sanibel Research Conference, Marineland, FL, 10 March 1986. (Presentation)

I developed a method to allow the calculation of polymer elastic moduli by semi-empirical methods. Heats of formation at several translation vectors are used to generate force constants. Results agree well with other predictions of the limiting modulus for several polymers.

c. With Captain Herbert E. Klei. "Calculations of Polymer Elastic Modulus by Semi-Empirical Methods." Presented at the International Symposium on Approaches to Property Limits in Polymers, Princeton, NJ, 11 August 1986. (Presentation)

See U17a

d. With Captain L.D. Strawser and Major D.M. Storch (both of DFC). "Computational Studies of Enzyme Catalysis Model of Alpha-Chymotrypsin." Presented to the Gordon Conference on Computational Chemistry, New London, NH, 21 August 1986. (Presentation)

Enzyme catalytic mechanisms are believed to exist as "active sites." The conjectured active site of chymotrypsin has been calculated using the AM1 method and the results compared with experiment. The mechanism of catalysis was briefly discussed.

e. "Explosive Outgassing at Cameroon Volcanic Lakes." Presented to the Agency for International Development, Office of Disaster Assistance, Washington, D.C., 4 September 1986. (Presentation)

Recent explosive outgassing at Cameroon lakes is most likely due to the build-up of carbon dioxide gas near the bottom of the lake. This gas build-up can be suitably released by the use of a small depth charge and would render the area safe, possibly for decades. Alternately, lime could be added to gradually neutralize the gas.

f. With Major Salvatore R. Bosco and Dr. William R. Carper. "Hydrogen Bonding Studies of 2,4,6-Trinitrotoluene." *Spectrochimica Acta*, 42A, No. 4 (1986): 461-466. (Article)

See U4b

g. "MNDO Calculations of Surface Phenomena." Presented to the Surface Contract Research Review, Dayton, OH, 6 November 1985. (Presentation)

Current calculations of carbon clusters simulating graphite and diamond surfaces were described. The minimum cluster size necessary to reproduce the surface electronic structure was identified.

h. "Molecular Orbital Calculations on Polymers." Presented as a Plenary Lecture at the Gordon Conference on Computational Chemistry, New London, NH, 21 August 1986. (Presentation)

The current state-of-the-art for calculating non-electronic properties of high polymers using cluster techniques was described and discussed. Particular attention was given to the geometry of polymers, heats of polymerization, and elastic moduli.

i. "MOPAC--A General MNDO and MINDO/3 Program." *Quantum Chemistry Program Exchange* No. 455, Vol. 5, No. 4 (1985): 133. (Article)

MOPAC is a general-purpose, semi-empirical molecular orbital program for the study of chemical reactions involving molecules, ions and linear polymers. It implements the semi-empirical Hamiltonians MNDO, MINDO/3 and AM1 and combines the calculations of vibrational spectra, thermodynamic quantities, isotopic substitution effects, and force constrants in a fully-integrated program. Within the electronic part of the calculation molecule and localized orbitals, excited states up to sextets, chemical bond indices, charges, etc., are computed. Both intrinsic and dynamic reaction coordinates can be calculated.

j. "MOPAC--A General Molecular Orbital Package, Version 3.1." *Quantum Chemistry Program Exchange*, No. 455, 6 (1986): 81. (Article)

After Version 3.0 of MOPAC was published, several small errors were found. These have been corrected in MOPAC 3.1. The new program contains some additional features, including the AM1 method.

k. "MOPAC--A General Molecular Orbital Package, Version 3.1, CRAY Version." *Quantum Chemistry Program Exchange*, No. 516, 6 (1986): 99. (Article)

This version of MOPAC is algorithmically identical to QCPE 455, but is tailored to run on the CRAY XMP supercomputers. The measured speed on the CRAY is 330 times of that of the VAX, for large systems. Typical increases in speed in the order of 60 to 150 times are more normal.

l. With Dr. Norman Heimer and Captain Jon T. Swanson. "MOPAC--A General Molecular Orbital Package, Version 3.1., IBM-PC Version." *Quantum Chemistry Program Exchange*, No. QCMP-019, 6 (1986): 99. (Article)

We wrote a version of MOPAC designed to run on the IBM-PC XT or AT. This version allows users with limited computer resources the ability to conduct research-quality work in semi-empirical quantum mechanics. A second anticipated use for this program is in college and university teaching.

m. "MOPAC CRAY XMP Manual (First Edition): A General Molecular Orbital Package." FJSRL-TR-86-0008. (Technical Report)

The supercomputer version of MOPAC is described, complete with installation and instructions for use. This version of MOPAC is partly vectorized to take advantage of the CRAY's architecture.

n. With Dr. Norman Heimer and Captain Jon T. Swanson. "MOPAC IBM-PC XT Manual (First Edition): A General Molecular Orbital Package." FJSRL-TR-86-0006, June 1986. (Technical Report)

We described the implementation of MOPAC on the IBM-PC XT or AT. The microcomputer version of MOPAC runs a subset of the full MOPAC program. A description of the program and instructions for installation and use are given.

o. "MOPAC Manual (Third Edition): A General Molecular Orbital Package." FJSRL-TR-86-0003. (Technical Report)

The MOPAC Manual has been extensively rewritten to clarify descriptions of facilities supported and to include descriptions of functions added since the last manual was written.

p. "MOPAC, Third Version, Second Edition: A General Molecular Orbital Package." FJSRL-TR-86-0003, June 1986. (Technical Report)

This is the second edition of MOPAC 3.0, a highly successful semi-empirical program for performing chemical calculations.

q. "Reply to 'Remarks on the Application of the MNDO Progam.'" *Quantum Chemistry Program Exchange*, Vol. 5, No. 4 (1986): 126-130. (Article)

MNDO programs have become widely used as a semi-empirical method to be used to solve computational chemistry problems. Some aspects of those applications are discussed.

r. With Wade W. Adams, R.K. Eby, P.J. Lenhart (all of Wright-Patterson AFB) and Captain Herbert E. Klei. "The Ultimate Modulus of Rigid Rod Polymer Fibers." Presented at the International Symposium on Approaches to Property Limits in Polymers, Princeton, NJ, 11 August 1986. (Presentation)

See U17d

s. With Major Salvatore R. Bosco and Dr. William R. Carper. "Vibrational Spectra of 2,4,6-Trinitrotoluene and its Isotopically Substituted Analogues." *Spectrochimica Acta*, 42A, No. 1 (1986): 13-21. (Article)

See U2b

37. STROH, Kevin A., Student and Research Assistant (GSSSP)

a. With Dr. Hermann J. Donnert, Mark A. Ferrell, and Gary W. Scronce (all of University of Kansas). "Effects of Electron Irradiation on the Optical Properties of Laser Mirrors." Presented at the 17th Annual Symposium on Optical Materials for High Power Lasers, Boulder, CO, 30 October 1985. (Presentation)

See U9a

38. SWANSON, Jon T., Captain and Research Associate

a. "Calculation of Tribological Properties by Semi-Empirical Methods." Presented at the Hughes/DARPA/AFOSR Contractors Meeting, El Segunda, CA, 13 March 1986. (Presentation)

I completed a detailed initial study of carbon surfaces and lubricants. I showed that a large cluster was an adequate method for a bulk material.

b. With Ira B. Goldberg, Ted M. McKinney, and Leslie F. Warren (all of Rockwell Science Center). "EPR Observation of Nitroxide-Free Radicals During Thermal Decomposition of 2,4,6-Trinitrotoluene and Related Compounds." *Journal of Physical Chemistry*, 90 (1986): 1008. (Article)

We presented evidence to support thermal decomposition of TNT, showing importance of the nitroxide radical.

c. With Dr. William R. Carper, Larry P. Davis (Bolling AFB), and R. Cameron Dorey (Medical College of Virginia). "An EPR Study of the Thermal Decomposition of Molten 2,4,6-Trinitrotoluene and its Isotopic Analogs." *Magnetic Resonance in Chemistry*, Vol. 24 (1986): 762-767. (Article)

Electron paramagnetic resonance spectroscopy has been used to probe the decomposition pathway of neat molten 2,4,6-trinitrotoluene (TNT). The analogs of TNT labelled in the 2-2,6-, and 2,4,6-positions with N, and labelled in the a -, 3,5- and a,3,5-position with H have been studied, and their spectra recorded at 240°C. The results indicate that the earliest observable radical produces a spectrum resulting from coupling with a para-N (a_N = 10.8G), five equivalent hydrogens (a_H = 2.7G) and two benzylic hydrogens (a_H = 10.7G).

d. With Dr Norman Heimer and Dr. James J.P. Stewart. "MOPAC--A General Molecular Orbital Package, Version 3.1, IBM-PC Version." *Quantum Chemistry Program Exchange*, No. QCMP-019, 6 (1986): 99. (Article)

See U36l

e. With Dr. Norman Heimer and Dr. James J.P. Stewart. "MOPAC IBM-PC XT Manual (First Edition): A General Molecular Orbital Package." FJSRL-TR-86-0006, June 1986. (Technical Report)

See U36n

39. TURNER, Almon G., Doctor and National Research Council Research Associate

a. "An Ab Initio Study of Isomerization in the HONO System." *Journal of Physical Chemistry*, 89 (October 1985): 4480-83. (Article)

Ab initio calculations were used to study the *cis-trans* isomerization of HONO. The geometries were completely optimized, and the *trans-cis* energy difference was calculated to be 3.5 kJ/mol, and the activation energy was 53.5 kJ/mol.

b. "On the Triplet States of HOCl and HClO." *Chemical Physical Letters*, 125, (1986): 451. (Article)

Post Hartree-Fcok calculations were used to investigate the lowest triplet states of HOCl and HCl0. The ^{3}A" state of HOCl is 48 kcal/mol above the ^{1}A' ground state. The ^{3}A" state of HCl0 could not be located.

40. WALKER, John M., Major and Research Associate

a. With Dr. David C. Chou (University of New Mexico) and Dr. William D. Siuru, Jr. "Aerodynamic Parameters for a Pitching Airfoil." Abstract Submitted to the AIAA 25th Aerospace Sciences Meeting, Reno, NV, 12-15 January 1987. (Presentation)

A rapidly pitching airfoil offers substantial increases in lift as well as drag. Wind tunnel measurements were made with a NACA 0015 airfoil pitched at several constant rates and wind tunnel velocities. We discuss the key aerodynamic parameters determined from these experiments.

b. "Dynamic Stall Wake Interaction with a Trailing Airfoil." Abstract submitted to the AIAA 25th Aerospace Sciences Meeting, Reno, NV, 12-15 January 1987. (Presentation)

Airfoils pitched rapidly to high angles of attack produce energetic vortical structures which, when shed into the wake, can have dramatic effects on downstream aerodynamic bodies. These effects are of critical importance if we are to exploit these forced unsteady flows for enhanced maneuverability.

c. With Julie A. Albertson and Dr. Tim R. Troutt (both of Washington State University). "Generation and Development of Vorticity about a Pitching Airfoil." Abstract submitted to the AIAA 25th Aerospace Sciences Meeting, Reno, NV, 12-15 January 1987. (Presentation)

Understanding the generation and development of vorticity about airfoils in unsteady flows is an important step toward developing insight into the important phenomena involved in unsteady aerodynamics about lifting bodies. The objective of this work is to separate the influence of surface pressure gradients and unsteady surface motions on the generation of vorticity from pitching airfoils. In addition, digitally enhanced flow visualization techniques were used to substantiate and clarify the implications of this analysis for specific experimental conditions.

d. "Unsteady Vortex Flows Driven by Pitching Airfoils." PhD dissertation and FJSRL-TR-86-0010, September 1986. (Dissertation and Technical Report)

Flow visualization and pressure and velocity measurement experiments were performed on a NACA 0015 airfoil rapidly pitching to high angles of attack to study the initiation, formation, development, and evolution of dynamic stall vortex flow.

e. With Lt Colonel Fred T. Gilliam (DFAN), Dr. Michael C. Robinson, and Captain John B. Wissler (DFAN). "Visualization of Unsteady Separated Flow about a Pitching Delta Wing." Abstract submitted to the AIAA 25th Aerospace Sciences Meeting, Reno, NV, 12-15 January 1987. (Presentation)

We determined the flow field structure about a delta wing as it pitches from 0 to 60 degrees at a constant pitch rate. We devoted special attention to the origin and evolution of the dynamic stall vortex.

f. With Lt Colonel Fred T. Gilliam (DFAN), Captain Henry E. Helin, Dr. Michael C. Robinson, and Major John H. Russell. "Visualization of Three-Dimensional Forced Unsteady Separated Flow." Paper No. 86-1066 to the AIAA/ASME Fourth Fluid Mechanics, Plasma Dynamics and Lasers Conference, Atlanta, GA, 13 May 1986. (Article)

See U27b

41. WILKES, John S., Doctor and Technical Director

a. With Jeffrey L. Boon and Lawrence Koons (Tuskegee Institute). "Bromine Electrochemistry in Chloroaluminate and Bromoaluminate Molten Salts." Presented at the EUCHEM Conference on Molten Salts, Geiranger, Norway, 21-26 August 1986. (Presentation)

The electrochemistry of the bromine/bromide redox couple was studies in chloroaluminate and bromoaluminate melts. Cyclic voltammetry showed that there are several processes due to complex formation.

b. "Chemistry of and in Room Temperature Chloroaluminate Molten Salts." Presented at Argonne National Laboratory, 15 January 1986. (Presentation)

Binary chloroaluminate eutectics, such as sodium chloride-aluminum chloride, have extraordinarily low melting points for totally ionic systems. Mixtures of certain organic halide salts with aluminum chloride form new salts that are liquid at room temperature. Some of these salts combine the high conductivity of a completely ionic liquid, the low freezing point of an organic solvent, the thermal stability of a classically molten salt and the broad solvating properties of aqueous electrolytes. The melt system comprised of aluminum chloride and 1-methyl-3-ethylimidiazolium chloride was described in terms of preparation, physicochemical properties and usefulness as an electrolyte in electrochemistry.

c. With Lt Colonel Armand A. Fannin, Jr., Major Charles L. Hussey, and Dr. William R. Scheffler. "Chloroaluminate Equilibria in the Aluminum Chloride 1-Methyl-3-Ethylimidazolium Chloride Ionic Liquid." *Journal of the Electrochemical Society*, 133 (1986): 1389. (Article)

The equilibrium constant for the autosolvolysis reaction of the 1-methyl-3-ethylimidazolium chloride/aluminum chloride molten salt was investigated. Values for the equilibrium constant and and the enthalpy change for the reaction were determined over the temperature range, 40-60°C.

d. With Dr. Bernard Piersma. "Electrochemistry of Ferrocene in 1-Methyl-3-Ethylimidazolium Chloride/Aluminum Chloride Room Temperature Melts." FJSRL-TR-86-0005, August 1986. (Technical Report)

Ferrocene has been studies in 1-Me-3-EtImCl-$AlCl_3$ melts over a range of Lewis acidities by varying the melt composition from 0.4 to 0.6 (mole fraction of $AlCl_3$). The redox potential for ferrocene is not influenced by chloride concentration in the melts and is 0.40 + 0.005 V (vs Al in 0.6 melt). Ferrocene is stable in basic and neutral melts but reacts chemically in acidic melts.

e. With Dr. Bernard J. Piersma. "Electrochemistry of Sulfur Na_2S, S_2, S_2Cl_2, and CS_2 in 1-Methyl-3-Ethylimidazolium Chloride--Aluminum Chloride Melts." FJSRL-TR-86-0009, August 1986. (Technical Report)

The electrochemical behavior of sulfur, sodium sulfide, sulfur monochloride, and carbon disulfide was studied on a glassy carbon electrode at 25°C in 1-methyl-3-ethylimidazolium chloroaluminate melts in basic (excess organic chloride), neutral (1:1 mole ratio of organic chloride and $AlCl_3$) regions. Cyclic voltammetry, rotating disk electrode and steady-state potentiostatic techniques were used in the study. The literature on sulfur and sulfur compounds in NaCl-$AlCl_3$ melts is reviewed and comparisons are made with the room temperature melts.

f. With Jeffrey A. Boon, Lt Colonel Joseph A. Levisky, and John L. Pflug. "Friedel-Crafts Reactions in Ambient Temperature Molten Salts." *Journal of Organic Chemistry*, 51 (1986): 480-483. (Article)

Dialkylimidazolium chloroaliuminate molten salts may be used as solvent and catalyst for Friedel-Crafts reactions at room temperature. The scope of the reaction was studied relative to alkylating and acylating agents and to aromatic substrates. The nature of the catalyst that promotes the reactions was established.

g. "NMR Spectroscopy in Molten Salts." Presented to NATO Advanced Study Institute on Molten Salt Chemistry, Camerino, Italy, 3-15 August 1986. (Presentation)

I reviewed of the use of nuclear magnetic resonance spectroscopy in molten salts. Examples in chloroaluminate melts are presented.

h. "Nuclear Magnetic Resonance in Molten Salts." Proceedings of the 1986 NATO Advanced Study Institute on Molten Salt Chemistry. (Article)

A comprehensive treatment of the results of nuclear magnetic resonance studies of room temperature molten salt systems was presented. The techniques are shown to be powerful tools in analysis and fundamental research into the chemistry of these novel systems.

i. "Organic Reactions in Chloroaluminate Molten Salts." Presented to NATO Advanced Study Institute on Molten Salt Chemistry, Camerino, Italy, 3-15 August 1986. (Presentation)

I presented a review of Friedel-Crafts type reactions in chloroaluminate molten salts. Most examples are from room temperature melts.

j. With Captain Herbert E. Klei, Dr G. Fredric Reynolds, and Dr. Towner B. Scheffler. "Preliminary Studies on New Molten Salt Systems based on l-Methyl-3-Ethylimidazolium Chloride and Metal Chloride Salts other than Aluminum Chloride." Presented at the Fifth International Symposium on Molten Salts, 168th Meeting of the Electrochemical Society, Las Vegas, NV, 15 October 1985. (Presentation)

Several new low temperature binary molten salts based on l-methyl-3-ethylimidazolium chloride and either LiCl, $ZnCl_2$, AgCl, or $CdCl_2$ are described. All are liquid near room temperature. We describe a method for determining the identity of metal ion complexes present in these melts, which indicates that $LiCl_2^-$, $ZnCl_4^{2-}$, $AgCl_2^-$, and $CdCl_4^{2-}$ are the predominant species present in their respective systems. Phase diagrams, along with heat capacity and thermal stability data are also presented.

k. With Jeffrey L. Boon, Lt Colonel Joseph A. Levisky, and Dr. G. Fredric Reynolds. "Reaction of Chlorine with Ambient Temperature Chloroaluminate Molten Salts." Presented at the Fifth International Symposium on Molten Salts, 168th Meeting of the Electrochemical Society, Las Vegas, NV, 15 October 1985. (Presentation)

Chlorine is a potentially useful cathode in electrochemical cells using low melting chloroaluminate molten salts as the electrolyte. Chlorine generated electrochemically in l-methyl-3-ethylimidazloium chloride--aluminum chloride melts or bubbled in the melt reacts with the imidazolium cation. This melt may be converted quantitatively to one where the cation is 4,5-dichloro-l-methyl-3-ethylimidazolium. Both basic and acidic melts are chlorinated, but the basic melts react at a much slower rate. Once the cation has been fully chlorinated, the melts appear to be resistant to further attack by chlorine. The chlorinated melts have higher melting points, higher viscosities, and lower electric conductivities than the unchlorinated melts.

l. "Room Temperature Molten Salts for Electrical Energy Storage." Presented to General Motors Research Labs, Warren, MI, 14 January 1986. (Presentation)

Binary chloroaluminae eutectics, such as sodium chloride-aluminum chloride, have extraordinarily low melting points for totally ionic systems. Mixtures of certain organic halide salts with aluminum chloride form new salts that are liquid at room temperature. Some of these salts combine the high conductivity of a completely ionic liquid, the low freezing point of an organic solvent, the thermal stability of a classically molten salt and the broad solvating properties of aqueous electrolytes. The melt system comprised of aluminum chloride and l-methyl-3-ethylimidiazolium chloride was described in terms of preparation, physicochemical properties and usefulness as an electrolyte in electrochemistry.

m. With Lt Colonel Armand A. Fannin, Jr. "Temperature--Composition Surfaces for Physical Properties of Aluminum Chloride--l-Methyl-3-Ethylimidazolium Chloride Room Temperature Molten Salts." FJSRL-TR-86-0004, July 1986. (Technical Report)

Molten slats composed of aluminum chloride and l-methyl-3-ethylimidazolium chloride are interesting and useful as electrolytes in electrochemical cells and as solvents for a variety of applications. The physical properties (density, electric conductivity, and viscosity) depend strongly on temperature and melt composition. In this report we show the properties plotted as three-dimensional surfaces using the graphics program, DISSPLA, which makes certain trends much easier to visualize.

AUTHOR INDEX

(by Chapter-Entry Code)

Acker, Bruce H. B1
Ali, Azar S. I1
Allgaier, Darrell E. P1
Anderson, John E. C1
Andrew, John M. P2
Andrews, J. David D1
Anthony, John F. B2
Aretz, Anthony J. C2
Arpin, David A. I2
Atchinson, Walter L. R1
Aubrey, James R. K1
Austin, Jeffrey S. C3
Austin, Walter W. O1
Avila, Walter B. E1
Bangs, Terry L. K2
Barnes, C. Taylor H1
Beason, J. Douglas R2
Becker, Marvin L. J1
Biever, Lawrence J. D2
Bloomer, Raymond H., Jr. R3
Boden, Daryl G. B3
Bohn, Courtlandt L. R4
Bolton, Jose C4
Boon, Jeffrey L. U1
Borowski, Harry R. M1
Bosco, Salvatore R. U2
Boudot, James R. P3
Bowers, Richard K. N1
Boyer, Kenneth G. R5
Braydich, Michael E. E2
Bright, Duane E. L1
Brock, John R., Jr. H2
Brost, George A. U3
Bubb, Keith W. B4
Burke, Joseph G. S1
Buron, Raoul J. C5
Bush, Michael D. L2
Byerley, Aaron R. A1
Canfield, John C. K3
Carper, William R. U4
Carpio, Ronald A. U5
Chiabotti, Stephen D. M2
Ciaffa, Robert J. K4
Cleckner, William H., IV P4
Clover, William H. C6
Cole, Donald D. S2

Cook, David A. G1
Cook, Richard J. U6
Cornelius, Raymond D. L3
Crane, Michael D. K5
Crawford, Michael L. R6
Crotty, Jill M. L4
Curry, Thomas F. P5
Czyzak, Stanley R. U7
Davis, James A. B5
Deaton, Terrence F. U8
DeBlois, Bruce A. P6
DeLorenzo, Michael L. B6
Donnert, Hermann J. U9
Drake, Marc C. B7
Drew, S. Nelson S3
Duke, John P. J2
Duprey, Richard J. A2
Durham, Richard R7
Dymek, Chester J. U10
Dziedzic, Michael J. S4
Elkin, Jerrold F. S5
Eller, Jonathan R. K6
Enger, Rolf C. R8
Erwin, Douglas L. T1
Evanchik, Michael A. O2
Evans, David J. R9
Ewing, Mark S. J3
Fallon, Gail A. C7
Fannin, Armand A., Jr. U11
Fazio, Salvatore B8
Ferrel, Mark A. U12
Fife, Dennis J. E3
Fisher, Alan R. D3
Fisher, Cary A. J4
Fleming, Kenneth H. H3
France, Martin B. B9
Francis, Vernon E. O3
Galbraith, Jay M. J5
Gardner, Robert S. N2
Garza, Mario A. T2
Gaspar, Charles J., Jr. K7
Giffen, Robert B. B10
Gilliam, Fred T. A3
Ginnett, Robert C. C8
Gist, Thomas E. R10
Gregory, Robert A. C9
Guyote, Michael F. I3
Hall, Roger L. B11
Hallgren, Wayne F. A4
Harvell, John K. A5
Hasskamp, Charles W. N3

Haussermann, John W., IV P7
Headlee, Christopher R. P8
Heimer, Norman U13
Helin, Henry E. U14
Helsabeck, Michael L. G2
Hess, Jeffrey W. B12
Hildreth, Robert A. E4
Hill, William A. N4
Hinger, Robert J. J6
Horne, Jerry D. R11
Houchin, Roy F. M3
Hoyle, Stephen C. P9
Hudlin, Charles W. Q1
Humble, Robert M. B13
Hussey, Charles L. U15
Jaeger, Bruce R. C10
James, William L. P10
Jeffrey, Bruce L. K8
Jenkins, Joyce R. G3
Johnson, Jeryl W. P11
Johnson, Milton H. P12
Jordan, Donald L. S6
Kankiewicz, Gary Q2
Kemp, Kenneth W. Q3
Kiemele, Mark J. P13
Killpack, Michael O. E5
Kinevan, Marcos E. N5
King, Lowell A. U16
King, Paul I. A6
Kirkpatrick, Douglas H. B14
Klei, Herbert E. U17
Kline, Larry R. A7
Knepell, Peter L. P14
Knipp, Delores J. R12
Kool, Leslie H. H4
Koons, Lawrence U18
Kramer, David F. F1
Krause, Kenneth L. G4
Kroncke, G. Thomas U19
Kull, Robert C. D4
Lamberson, Steven E. J7
Lander, Stephen W., Jr. U20
Larivee, David R. H5
Larsen, Jeffrey A. S7
Lemak, David R. O4
Lemp, Richard W. L5
Leuthauser, Paul R. B15
Levisky, Joseph A. U21
Lewis, Keith A. I4
Liefer, Randall K. B16
Linn, Dennis Q4

Lisowski, Ronald J. B17
Lorenz, Mark A. B18
Lorenzen, Gary L. R13
Lorenzen, Jay S8
Losiewicz, Paul Q5
Luttges, Marvin W. U22
Mallary, Thomas C. G5
Manson, Harold C. N6
Mark, Martin B. I5
Marksteiner, Joseph P. J8
Martin, Daniel L. I6
Martin, Harold L. A8
Martin, Jerome V. T3
Martinez, Ramon Q6
Mattingly, Jack D. A9
Mayse, Chris M. M4
Meilinger, Phillip S. M5
Mercier, Daniel E. B20
Meyer, Howard R., Jr. E6
Miller, Doris A. K10
Mitchell, Tony L. P16
Monaghan, Glen E. I7
Monroe, Joseph G7
Moody, Theodore J. I8
Moore, Rita A. O5
Mueh, Hans J. E7
Muller, Clifford H., III U23
Mullins, Bill W. R17
Murray, Douglas J. S9
Murrow, Richard C. P17
McCarron, William E. K9
McCloy, Thomas M. C11
McGillen, Donald J. P15
McKenney, David G. G6
McKnight, Darren S. R14
McNally, James J. R15
McQuade, Marilyn K. R16
McQuade, Peter D. B19
Nalabandian, Jacques L6
Nelson, Douglas H6
Neumann, David K. R18
Nicholson, Brian J. M6
Nicholls, David J. J9
Nici, Rosario B21
Nielsen, David C. H7
Nielsen, Donna S. P18
Nielsen, Michael J. P19
Nilson, Jimmy D. G8
Nilsson, Cheryl L. N7
Noetzel, Jonathan C. E8
Nunez, Anthony C. J10

O'Connell, William T. T4
Pala, Antonio L. L7
Papirtis, Michael F. H8
Patton, Mark W. C12
Pecor, Bruce R. I9
Pflug, John L. U24
Piersma, Bernard U25
Pizzi, Robert E. O6
Pomrenke, Gernot S. R19
Porter, David B. C13
Rachocki, Kenneth D. E9
Rallo, Joseph C. S10
Raney, Terry L. H9
Reddell, Carl W. M7
Reynolds, G. Fredric U26
Reynolds, Michael F. F2
Rhoades, Nancy A. B22
Rhoads, Harold S. B23
Richardson, William E. G9
Riggs, Gregory E. F3
Riggs, Tom L., Jr. B24
Ripley, J. Douglas D5
Robertson, Joan A. K11
Robertson, David R. I10
Robichaux, Leonard M. J11
Robinson, Michael C. U27
Rogers, Kenneth A. S11
Rojas, Fernando P. I11
Romberger, Andrew B. U28
Rotge, James R. U29
Roth, Russell T. H10
Russell, John H. A10
Salvati, James R. H11
Sampson, Orwyn D6
Scheffler, Towner B. U30
Schelhaas, Douglas P. D7
Schmidt, Stephen R. P20
Schoen, Robert J. C14
Schweitzer, Dennis L. G10
Scronce, Gary W. U31
Scully, James E. T6
Shaw, Bryant P. M8
Shields, George I. D8
Shuttleworth, Jack M. K12
Siegenthaler, Kenneth E. U32
Simmons, Bill J. U33
Siuru, William D., Jr. U34
Slate, Mitchell P. B25
Smith, Herbert R. K13
Smith, Joseph L. F4
Smith, Scott M. M9

Smith, W. Flint L8
Soda, Kenneth J. I12
Sonobe, Blake I. E10
Spinner, Frank J. N8
Stech, David J. U35
Steigerwald, Robert A. G11
Steigerwald, Silvi K. I13
Steinbach, Wayne, R. R20
Stewart, James J.P. U36
Storch, Donn M. E11
Strain, Efren C. A11
Strawser, Larry D. E12
Stroh, Kevin A. U37
Summer, Peter D. E13
Sutherland, Richard L. L9
Svetz, Holly E. B26
Swanson, Jon T. U38
Swanson, Richard E. R21
Tamame, Jose L10
Tate, Ralph H., III B27
Tessmer, George W. E14
Thomson, John M. K14
Tillinghast, Henry S. D9
Tomlinson, Robert L. G12
Toole, Joseph E. D10
Tower, Patrick Q7
Traficanti, Joseph J. N9
Tretler, David A. M10
Trimboli, M. Scott B28
Turner, Almon G. U39
Turner, Glon D. J12
Utermoehlen, Clifford M. E15
Varni, James G. R22
Vergez, Paul R. B29
Vetter, James C. P21
Viotti, Paul R. S12
Von Wald, Conrad N10
Wachinski, Anthony M. F5
Wakin, Malham M. Q8
Walker, John M. U40
Waller, Robert L. H12
Walsh, Stephen J. P22
Weadon, Mark P. K15
Weaver, Larry A. M11
Wernle, Kenneth R. B30
Westbrook, Christopher R23
Whitehouse, Stephen R. J13
Wilkes, John S. U41
Williams, Michael S. C15
Winn, Robert C. A12
Winstead, Charles L. C16

Wissler, John B. **A13**
Wood, Frank R. **C17**
Worsowicz, Christopher J. **B31**
Wright, Edward N. **S13**
Wright, James R. **E16**
Yechout, Thomas R. **A14**
Zink, Jeffrey **Q9**

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SUBJECT INDEX

(by Chapter-Entry Code)

AFIT programs **P2a**
AFR 25-5 ..... **P20c**
Academy training philosophy **T4a**
Acidic melts **U5a, U11c, U16a**
Acrylic polymers **U28a, U32a**
Acylating agents **E1h**
Ada **G1a, G3a, G3b**
Administrative law **N8a**
Advanced placement exams **K12a, K12b**
Aerodynamic performance **A3b, A6a**
Aerodynamics of wings **A4a**
Aerospace operations **F5a**
Afghanistan, Soviet invasion of **M9c**
Africa **M8a, M8b, S6, S6b, S6c**
Africa, in world history **M8a, M8b**
Africa, isolation and progress of **M8a**
Agricultural biotechnology **D5b**
Air Force Academy, history of **M1a**
Air Force engineering **F5a**
Air Force leadership **M1c**
Air Force organization **C15a**
Air Force pilot training **M2a**
Air law **N6c, N4a**
Air officers commanding **C3a, C6a, C17a**
Air propeller, history of **M6a**
Aircraft cruise performance **A14a**
Aircraft noise **D3a, D4a**
Aircraft refueling robot **I7a**
Aircraft stability **B26a**
Aircraft structures **J3c, J4c**
Airfoils **A5a, A10a, U34a, U40a, U40b, U40c, U40d**
Airfoils, elliptical **A5b**
Airline crews **C8a, C8b, C8d, C8g**
Allocation of fixed resources **O3b**
Allylic amines **U20a**
Alpha-chymotrypsin catalysis **E11d, E11e, E11h, E12f, E12g, E12k, U36d**
Aluminum-Copper-Lithium-Zirconium alloy **J5b, J5c, J5d, J5e**
American Constitutional law **N1b**
American legal system **N1c**
Antony and Cleopatra **K15b**
Apple IIe microcomputer **J3f**
Applied psychology **C3b**
Arab literary revival **L6a**
Archilochus **K11a**
Arms control **S2b, S2c, S12f**
Articulatory suppression **C13b**

Artificial intelligence **G6a, I13b, I11b**
Assertive followership skills **T4a**
Atmospheric diffusion **P12b, P15a**
Atomic fluorescence **U6a, U6b**
Automated math placement model **P3a**

Balikesir, Turkey **H1a**
Beam energy **E9b**
Behavioral activation **C16b**
Behavioral workload assessment **C11a**
Belgian Congo **M8b**
Bigelow, Lt. John **N5b**
Biotechnology **D5a, D5b, E12a, E12b, E12j**
Bird breeding **D3b**
Black humor **L5b**
Body composition **D6a, D6c**
Body fat/water ratio **D6b**
Brescia **K7a**
Bromine electrochemistry **U1a, U18a, U41a**
Browning, Robert **K13d**
Burnout, professional **C3f**

CAIS **G3a**
Cadet leadership **C5a, C17c**
Calculus **P8b, P13e**
Cameroon volcanic lakes **U36e**
Canadian defense policy **S9a**
Career decisions **C12a, C15a**
Catch-22 ..... **K1b, K6d, K12c**
Ceratophyllus idius **D7a, D7b, D7c, D7d**
Chemiluminescence **U7a, U23a, U35a**
Chemotaxis **D9a**
Chloroaluminate equilibria **U15a, U30a, U41c**
Chloroaluminate molten salts **U1c, U11a, U18a, U20, U26c, U41b, U41i**
Civil engineering, education in **F3a, F3c**
Cleartran **R22a**
Climatology **P5b, R7e**
COBOL **G1a**
Cognitive processes **C13e**
Cognitive psychology **C13a**
College dropouts **P20a**
Colorado Springs economy **H3b, H5a**
Competition at USAFA **C17d**
Compton scattering **R2a**
Computer-aided design **I8g**
Computer cartography **H8a**
Computer games **C13h, C13i**
Computer-aided instruction **A1a, A12a, E8b, E11c, E11i, E12d, E12e, E14a, B15a, B25b, C7a, R1a, R8c, R10a, R11a, R16a, R21a**
Computer-generated imagery **G10a**
Computer network simulator **P13a, P13b**
Computer science, curriculum **G8a**

Computer science, education G7a, G7b
Computer software G2a, G9b, G11a
Computers, role of in design F3d
Computers, use in chemical education E12l
Computers, use in classroom K7b
Computers, use in engineering J4a
Computers, use in mathematics P8b
Constitutional law N1b
Continuous functions P7a
Corporate entrepreneurship O2a, O5e
Criminal law N6b
Cryptographic schemes P13c
Current doctrinal issues T6a

Data communications I6a, I6d, I10a
Davies, Joseph E. M11a
Defense contracting O2b
Defense economics H9a, H9b
Dempster-Shafer theory P4a
Denmark, security policy S7a
Dictyostelium D9a
Differential equations P8b, P12b, P15a
Digital computer simulations B24a
Displacement gage J13a
DNA technology E12i
Douglas, Ellen K3c
Dynamic pressure measurement A11a
Dynamic stall U14a, U22b, U27a
Dynamic systems P7b
Dyna-soar M3a, M3b

Early terrestrial atmospheres R7a, R7c, R7d
Education in mechanics J4b, J4d, J4e, J3g
Education, role of Q8f, C9a, C11e
Education, technology of L2a
Eisenhower and NATO T1a
Elastic moduli U17c, U36b, U36c
Electron spectrometer R5b
Electronic voice and communicator I8a
Electro-optic system P22a
Elliptical airfoils A5b
Emergency preparedness (U.S.) S13d
Encyclopedia USA K6a
Engineering fundamentals B2a, B6b, B20a, B27a
Enlisted personnel H3a, H7a
Environment D2a, N6a
Enzyme catalysis E11b, E12c
Enzyme properties E11i
Epoxy interlayers J1a, J3e, J9b
Erbium R19a
Estate planning N3a, N5a, N7a, N7b, N9a, N9b, N10a
Ethics, professional Q6a, Q8c
Ethics, teaching of Q9b

Europe, defense of **S10a, S12b, S12c, S12d**
Excused exams **A12b**
Exercise and stress **C3h, C4a**
Existential psychotherapy **C5c**
"EXPERT" program **F1a**
Extralinguistic variables, Spanish language **L1a**
F-15, STOL **B1a**
Fatigue crack growth **J9c**
Federal subsidies **H2a**
Ferrocene **U25a, U41d**
Fiber optics **R7b**
Financial planning **N3a, N7a, N9a, N9b, N10a**
First amendment, establishment clause **N8b**
Flat plate airfoil **A10a**
Flexible beam experiment **B4a, B13a, B31a**
Flexural rigidity sensor **J3d**
Flight simulators **M2a**
Flight training anxiety **C5e**
Flight vehicle dynamics **A2a**
Floristic survey **D5c**
Foreign language education **L8d**
Fraternization **Q2a, C6c, C17e**
French Lieutenant's Woman **K1b**
Friedel-crafts acylation **E1c**
Friedel-crafts reactions **U1b, U21a, U24a, U41f**
Frozen orbits **P17a**
Frunze-Trotsky debates **M9e**

Galicia **H4a**
Galvanic cells **U10a, U26a**
Geography, world **H1e**
Geokinetics **B18c**
God, existence of **Q8e**
Government acquisition programs **H3c**
Graphite/epoxy laminates **J11a**
Grau, Shirley Ann **K3a**
Gravity's Rainbow **K9d**
Greene, Nathanael **M10a**

Hardened structures **F4a, J13d**
Health index prediction **P4b, P20b**
Heat sinks **I8b**
Hegel **Q7a**
Helicopters, armed **L10a**
Heller, Joseph **K1b, K5b, K6d, K8a**
Heterocyclic aromatic aldehydes **E5a**
Hexanitrotolanes **E1d, E11f**
Hibernation **D1a**
High-stiffness composites **J1a, J3e, J9b, J9c**
HOCl and HClO **U39b**
HONO system **U39a**

Hobbes, Thomas **K9d**
Hogarth, William **K9d**
House Behind The Cedars **K5a**
Howell, William D. **K6a, K6b**
Human-computer interface **G5a**
Human factors **C11c**
Human resources, Soviet view **M7a**
Hurricanes **P5a**
Hydrogen bonding **U2a, U4b**

Immiscible alloy solidification **J12b**
Impulse measurement **U3a, U8a**
Indian Wars **N5b**
India's defense policy **S5a, S5b, S5c, S5d**
Indo-Pakistani military balance **S5e**
Inertial sensors **B18c**
Information processing **C13g**
Instructional styles **P14a**
Instrumentation **I8c**
Interactive communications simulator **I6b**
Interactive videodisc instruction **L4a, L9a, L9b, L9c, L9d**
International Chemistry Olympiad **E1a, E1b, E2a, E13a, E16a**
International relations **S12a**
International terrorism **Q1a**
Interpersonal skills **C5d**
Interservice rivalry **S9b**
Iodine lasers **U3b, U8c**
IOGEN **G3b**
Ion-assisted deposition **R15a, R15b, R15c, R15d, R15e, R15h, R15i**
Iranian hostage crisis **S3d**
Isomerization **E3a, E3b, E3c**
Iso-pad **U33a**
Italy **S10b, S10c**
Jet engine design **M6a**

Karman vortex sheets **A13a**
Knowledge, implicit and explicit **C13f**
Korteweg-DeVries solutions **P1b, P1c**

Lagrangian framework **R2b**
Laminated composite plates **J3a, J3g, J3i, J3f, J3h, J6a**
Laminated plates **J3a, J3b, J3g, J3i, J3f, J3h, J6a, J6b**
Laser-based instrument development **U29a**
Laser damage **R17a, U8b, U28a, U32a**
Laser development **R18a, R18b, R18e, R18g**
Laser diodes **U35b**
Laser feedback control **B18a, U29b**
Laser induced vaporization **R22a**
Laser mirrors **U9a, U12a, U29c, U31a, U37a**
Laser photolysis **R18c**
Laser radar system performance **I5a**

Laser-solid interaction **R12a, R17a**
Laser-suppored detonation waves **R4a, R6a**
Lasers, repetetively-pulsed **R4b, R6b**
Laser surface-to-air threat **B19a**
Laughter, use of **L3a**
Leadership **T5a, C8c, C8f, C9c, C9d, C9e, C9i, C17f**
Learning styles **P14a**
Legislation **H6a**
Leopold, Aldo **K1b**
Le Poeme du Quinquina **L5b**
Life insurance **N7c**
Listening comprehension process **L1a**
Lithium electrodes **E9a, E9c**
Logic **Q3h**
Lyapunov stability **B29a**

Maine **K3b**
Maritime strategy **Q5a**
Marxism **M9a**
Materials processing **J12a**
Math 211 experiment **P13d**
Math placement **P20d**
Mathematics and reality **Q8d**
Mean equipment corrective maintenance time **P6a, P12a**
Mega choice **B12a, B12b, B21a, B21b**
Memory load **C13c, C13i**
Metal vapor excimers **R18g**
Mexican national security policy **S4a, S4b, S4c**
Microcomputers and military theory **T2a**
Microcomputers, impact of **P14b, B11a, C7a**
Military aircraft engine overhauls **O5f**
Military chaplaincy **N8b**
Military clubs **C9b**
Military history **M7c**
Military impact **H3b, H5a**
Military justice **N5b**
Military planning **M1b**
Military profession **C17h**
Military retirement **H1c**
Military schools **K1a**
Military service retention **O4a, H10b**
Military service turnover **O4a**
Military and social integration **S5f**
MNDO calculations **U36g, U36q**
Mobile robots **I7a**
Mobilization actions **H11a**
Moliere **L5a, L5b**
Molten salts **U1a, U1b, U1c, U10a, U11d, U17b, U24a, U26b, U26c, U30b, U41a, U41b, U41f, U41g, U41h, U41i, U41j, U41k, U41l, U41m**
Montaigne, Michel de **K14a**
MOPAC **U13a, U13b, U36a, U36i, U36j, U36k, U36l, U36m, U36n, U36o, U36p, U38d, U38e**

Motorized gliders **P18a**
Multinational corporate structure **O4c**
Multiple jet blowing **A5a**
Multi-unit structure test (MUST) series **J10a, J13b, J13c, J13e**

National defense **S9c, S12g, S13a, S13b, S13c, S13d**
Natural Sciences **Q3f**
Navigation accuracy **B14c**
Navigation guidance **B9a, B28a**
Nephrogenic diabetes insipidus **D8a**
Network flow problems **O3a**
Network topologies **P16a**
1981-53 fragmentation event **R14a**
Nonconforming work **N2c**
Nonlinear filters **B3a**
Nuclear deterrence **Q3b, Q3d**
Nuclear weapons **Q3a, R23a**
Nucleation **J5a, J5d, J5e**
Nucleaus basalis lesions **C16a**
Officer accession, USAF **K6c**
Officer retention **H10b**
Optical fiber communications **I3a, I9a, I11a**
Optical films **R15a, R15b, R15c, R15d, R15e, R15f, R15g, R15j**
Optical lasers **R18d, R18f, R18g**
Optical phase conjugation **P21a**
Optical rotation sensors **U19a, U29d, U33b, U35c**
Optics structure experiment **B17a**
Orbit determination **B3a, B3b**
Organizational effectiveness **O4b**
Organizational stressors **C3e, C5e**
Oxford, influence of **K3e**

Palestinian Liberation Organization **L6b**
Parallel processors **I2a, I2c**
PARSOR **I2c**
Particle beams **R20b, R20c**
PASCAL **G12a**
Peak-finding algorithm **P13e**
Personal planning **N7a, N3a, N7b, N9a, N9b, N10a**
Physical chemistry **E11g, E11i, E12h**
Physical exertion **C10a**
Physics and literature **K9a**
Pilot attitudes **C9f, C9g**
Pindar **K11a**
Plant biotechnology **D5a**
Plant closings **O4d**
Pluto **Q3e**
Polyammonium nitrate salts **E4a**
Polycyclic aromatic hydrocarbons **E15a**
Polymer elastic modulus **U17a, U36c**
Polymer fibers **U17d, U36r**

Polymers E11a
Polymers and calculations U36h
Polynitrophenyl acetones E1h
Pope, Alexander K1b
Population characteristics O1a
Private ownership M4a
Production systems P11a
Productivity C8e
Progam for handling data (PHD) U11b
Property N3b
Proton spectrometer R5a, R5b
Psychology at USAFA C9h
Pynchon, Thomas K9d

Quadratic programming P9a
Quartz crystal E6a

Rare-earth elements R19a, R19b
Real estate, buying and selling N1a
Rectangular wing analysis A7a
Residential property N7e
Rich Brides K13e
Ring laser gyros B18d
Romantic poetry K15a

Satellite breakups R14b, R14c
Scandinavian politics S7c
Science, philosophy of Q9a
Shakespearean comedy K13f
Sight reading L7a, L7b, L8a, L8b, L8c
Software, cost estimation H12a
Software, educational F2a
Solar radiation E3d
Solid state research I12a
Solitary wave tails P1a, P1b
Soviet airborne doctrine M9b, M9e
Soviet Air Force, air-to-air tactics M9e
Soviet challenge in Africa S6b
Soviet foreign policy S11a, S11b, S11c, S11d, S11e
Soviet military history M9d
Soviet power M7c, S3a
Soviet use of mass media S3e
Space academics B6c, B14b, B22a, B25a, B27b
Space debris R14c
Space law N4a, N4b
Space shuttle B4a, B13a, B31a
Space station design C17b
Space structure control B5a, B6d, B7a, B12c, J2a, J7a
Space system survivability B10a
Space weapons B23a
Spain, geography of H1d

Spanish culture **L10c**
Spanish language **L1a, L10b**
Spanish military **L10d**
Spanish politics **S7b**
Spatial ability **C11b**
SPD Linear Systems **I2b**
Speech data base **I3b, I3c, I4a**
Speech mimicking system **I13a**
Speech Recognition **I3c**
SPICE **I8e, I8g**
Spirometra Mansonoides **D10a**
Stalin purge trials **M11a**
Static line retriever (C-130's) **J8a, J9a**
Strategic Defense Initiative B16a, B22b, B30a, R14c, S13d, Q3c, Q3g, H10c, B8a, B12d, B14a
Strategy and tactics **Q5b, S3c**
Strehl intensities **R17a**
Stress in space flight **C3g**
Subsonic wind tunnel **A3b**
Sulfur Na_2S **U25b, U41e**
Supermarket writing **K9b, K10a**
Survivor benefit plan **N7c**
Swept wing analysis **A7a**
Syria **K13c**
System advice **C2a**

T-41 flying requirements **H7b**
Task performance **C13d, C14a**
Taxes **N7d, N7e, N9c**
Tax Reform Act **N7e, N9c**
Teaching physics **R3b, R8a, R8b, R9a, R10a, R11a, R13a, R16a, R20a, R21a**
Team effectiveness **C1a, C3d**
Team teaching **R3c**
Tension measuring devices **J8a, J8b, J9a, J9c**
Thermodynamics **A1a, A12a**
Three-dimensional forced unsteady separated flow **A3a, A10b, U14b, U22a, U22c, U27b**
Time-domain reflectometry **I1a**
Time management **O5b**
Time measurement **R3a**
Torts **N10b**
Traditional values **K6c**
Transonic flutter analysis **A7a**
Trend analysis **G6b**
Tribological properties **U38a**
Trinitrotoluene **U2a, U2b, U4a, U4b, U4c, U36f, U36s, U38b, U38c**
Trifluoromethanesulfonate esters **E4b**
Tropone **E10a**
Turbine blading, high performance **A6a**
Turbine stage **A8a**
Turbofan engine **A9a**
Turkey **H1a, H1b**
"Two presidencies" **S2a**

UHF satellite antenna **I6c**
Ultraviolet lasing **R1a**
Undergraduate computer science **G7a**
Undergraduate space training **B9b, B27c, B28b**
United States, Soviet view of **M7b**
Universal filter **I8f**
Unsteady separated flow **A3c, A13b, U14b, U27b, U40e**
U.S. and Africa **S6a**
U.S. arms transfer policy **S1a, S1b**
U.S. Chemistry Olympiad **E1f, E13b, E1g, E13g, E16b, E16c**
U.S. military planning **K13b**
USAF, bomber fleet **O5a, O6a**
USAF, environmental policy **D2a, N6a, H10a**
USAF, security guards **C6b, C17g, C11d, C11e, C12a, C15a, C17h**
USAF, Tactical Air Forces **T3a**
U.S. - Soviet agreements **S11e, S12e**
UV-18 floater bar **J6c**
Vandenberg, Hoyt S. **M5a**
Variations arcs **P17b**
Vietnam war **K7c**

War, morality of **Q8b, Q8g**
War, principles of **Q8b**
West Germany, politics of **S7d, S7e, S8a, S8b**
Wind tunnels, studies of **A5b**
Women in military **O5f**
Women's studies **K3c, K3d**
Writing, teaching of **K2a, K9c**

X-29 flight test program **A14b**
Xenon difluoride **E1e, U13c**

Yugoslavia, press freedom in **S3b**

Zenith Z-248 computers **P8a, P10a, P19a**

FOR MORE INFORMATION. . .

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